

AI-Driven Academic Excellence by Building an Advanced Student Performance Analysis System

PROF. DR. REKHA SUGANDHI¹, KRISHNAPRASAD VENKATESH AWALA², TUSHAR KUMAR TAILOR³

¹ Head of Department (HOD) – IT, MIT ADT School of Engineering, Rajbaug, Loni, Pune, India

^{2,3} Student, MIT ADT School of Engineering, Rajbaug, Loni, Pune, India

Abstract— In the world of student overall performance evaluation, conventional assessment methods frequently fall quick in capturing the multifaceted nature of pupil success. This paper introduces a unique approach to student performance evaluation, aiming to head past quantitative metrics and encompass a holistic view of pupil development. By leveraging modern technologies and facts-pushed frameworks, our proposed system seeks to offer educators with comprehensive insights into student overall performance, allowing customized getting to know techniques and knowledgeable choice-making. Through dynamic dashboards and interactive visuals, educators can discover pupil facts across various dimensions, uncovering traits and styles that traditional strategies might also neglect. This paper outlines the improvement of an included system that mixes authentication, dashboards, questionnaires, and records importing/parsing functionalities to create a sturdy platform for student overall performance evaluation. The closing purpose is to empower educators with the gear they want to manual students closer to fulfillment of their educational journey.

Index Terms—Student Analysis System, Holistic Assessment, Quantitative Metrics, Web Application, OCEAN Traits

I. INTRODUCTION

In the trendy academic landscape, assessing student overall performance goes past traditional metrics to encompass a holistic information of student development. The advent of AI and advanced technology gives new possibilities to enhance academic excellence by offering educators with deeper insights into student information. This introduction sets the level for our research, which specializes in developing an AI-driven student overall performance evaluation system to empower educators and optimize students gaining knowledge of outcomes. By combining cutting-edge technologies with information-driven methodologies, our gadget

pursuits to deal with the limitations of current assessment strategies and pave the way for extra personalized and effective educational practices.

II. PROBLEM STATEMENT

The present day methods used for assessing pupil overall performance are confined to their scope and effectiveness. Quantitative metrics, even as treasured, do no longer offer a whole picture of a pupil's ability and capability. This paper identifies the need for an extra holistic approach to student overall performance analysis that takes under consideration elements consisting of vital wondering, collaboration, and socio-financial heritage. Additionally, there's a loss of incorporated systems that allow educators to successfully acquire, analyze, and visualize student facts throughout numerous dimensions. Addressing these demanding situations calls for the improvement of a complete student overall performance analysis system that leverages current technologies and statistics-pushed approaches.

III. EXISTING SYSTEM

Traditional techniques of student overall performance analysis depend typically on quantitative educational metrics, including grades and standardized test ratings. While these metrics provide treasured insights into pupil achievement, they frequently forget different vital elements that make a contribution to a student's ordinary success. Furthermore, existing structures for collecting and analyzing student data may additionally lack integration and scalability, making it difficult for educators to derive meaningful insights. This segment offers an essential exam of the restrictions of contemporary assessment methods and highlights the

want for a more complete method to pupil overall performance evaluation.

IV. LITERATURE SURVEY

A background examine is done to check similar current structures used to perform student performance analysis. These already existing systems are selected because those systems are similar to the proposed system.

1. Student Performance Analysis System (SPAS)

This paper outlines Student Performance Analysis System (SPAS)[1] comprising Admin, Faculty, and Student Modules, developed the use of HTML, CSS, PHP, and MySQL. HTML systems web pages, CSS patterns them, and PHP helps database connectivity and operations. The system allows person registration, end result viewing, and dynamic facts visualization the use of Fusion charts. By centralizing facts series from college management, the SPAS aims to enhance educational outcomes through intuitive interfaces and analytical equipment.

2. Student Performance Analysis System (SPAS)

The proposed SPAS[2] integrates user-friendly interfaces, performance prediction abilities, and document generation functionalities to meet educators' desires. Key features which includes performance prediction algorithms and PDF file generation align with stakeholders' requirements, emphasizing the importance of records-driven decision-making in enhancing teaching practices and student consequences. By prioritizing intuitive interfaces, predictive analytics, and comprehensive reporting, SPAS solutions provide educators precious insights to aid pupil learning and pressure non-stop development in instructional settings.

3. Faculty Support System (FSS)

Shana and Venkatacalam has proposed a framework named [3]Faculty Support System (FSS) which is low in fee as it makes use of price effective open supply evaluation software, WEKA to examine the students' performance in a route presented via Coimbatore Institute of Technology of Anna University [1]. FSS is capable of examine the students' information dynamically as it may update of college students' information dynamically with the drift of time to

create or upload a new rule. The update of latest rule is possible with the assist from area professional and the rule of thumb is determined with the aid of statistics mining approach including type method. Classification method is used to predict the students' overall performance. Besides, FSS focus at the identification of factors that make contributions to overall performance of college students in a particular route.

An assessment of current literature exhibits a developing interest in holistic tactics to student performance evaluation that move beyond traditional metrics. Researchers have explored the position of things which includes crucial wondering, collaboration, and socio-monetary background in shaping pupil consequences. Additionally, there may be a developing frame of research on the use of generation and records-driven frameworks to enhance student evaluation and personalized getting to know. By synthesizing insights from preceding studies, this paper aims to construct upon present know-how and make a contribution to the development of a higher student overall performance evaluation gadget.

V. OBJECTIVES

The objectives of this paper are twofold: first, to discover the constraints of current methods for assessing pupil performance and 2d, to advocate a singular system that addresses those limitations. Specifically, we intend to develop an integrated platform that allows educators to collect, examine, and visualize student records throughout a couple of dimensions. By leveraging current technologies and records-pushed frameworks, our proposed system seeks to offer educators with complete insights into student overall performance, facilitating knowledgeable decision-making and personalized learning techniques. Ultimately, the goal is to empower educators with the equipment they want to guide student success in the lecture room and past.

VI. PROPOSED SYSTEM

Our proposed student performance evaluation system is designed to deal with the restrictions of current evaluation methods by providing educators with comprehensive insights into student development. The

system integrates authentication, dynamic dashboards, questionnaire functionalities, and records importing/parsing abilities to create a sturdy platform for student performance analysis. By leveraging cutting-edge technologies consisting of AI and system mastering, the system enables educators to uncover tendencies and styles in pupil records, informing fact-based choices and customized studying techniques. Through a consumer-pleasant interface and interactive visuals, educators can explore pupil information across diverse dimensions, gaining a deeper know-how of each student's strengths and regions for boom.

• Key Features:

Power BI Integration: Users get entry to interactive dashboards embedded from Power BI, supplying comprehensive insights into attendance, marks, and personality traits at a glance.

Database Integration: MongoDB serves because the backend database, facilitating smooth control of attendance information, marks, and questionnaire responses. Professors can upload Excel sheets without delay from the application for efficient statistics dealing with.

Questionnaire Module: Professors administer personality trait questionnaires to college students, framing questions primarily based at the OCEAN (Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism) traits. The system dynamically generates tailored questionnaires to enhance engagement and relevance.

system Learning Model: A system mastering version evaluates students' OCEAN tendencies and Kolb's Learning style based on questionnaire responses. The version's output is displayed within the developments dashboard, presenting precious insights into studying preferences and character characteristics.

Dashboard Visualization: Interactive dashboards visualize attendance statistics, marks distribution, and character trait analysis. Fusion charts and other visualization gear decorate facts comprehension, facilitating informed selection-making.



Fig. 1. Dashboard

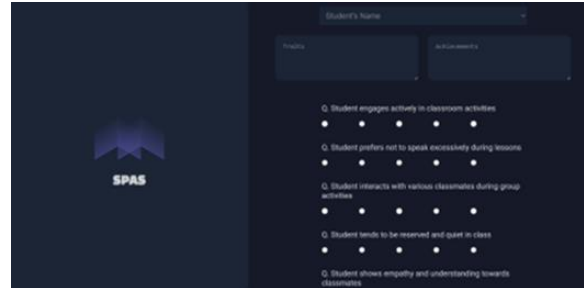


Fig. 2. Questionnaire

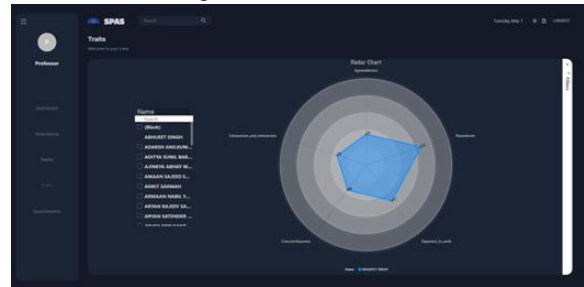


Fig. 3. Main Application

VII. TECHNOLOGY STACK

A. Frontend

React.js:

React.js is used for building the client interface of the web application. React.js offers a component-based architecture, enabling the developer to create dynamic and interactive UI fast.

Redux:

Redux is a state management library, it is utilized for state management, especially vital in greater applications where the state has to be centralized and coordinated capability over components.

Power BI:

Power BI is a tool used for data visualization, it has been used in the web application for showing the students data by extracting it from the database.

B. Backend

Node.js:

Chosen as the runtime environment for the backend server. Node.js empowers interesting, event-driven building, making it sensible for taking care of I/O-heavy operations.

Express.js:

Express.js is a backend web framework for building RESTful APIs with node.js. Utilized as the web application system for Node.js. Express.js disentangles the creation of extraordinary APIs and takes care of HTTP demands, engaging dependable communication between the frontend and backend.

MongoDB:

MongoDB is a source-available, cross-platform, document-oriented database program. Classified as a NoSQL database product, MongoDB utilizes JSON-like documents with optional schemas. MongoDB is developed by MongoDB Inc. MongoDB has been used in the web application as the primary database where all the data of the users as well as all the data of the excel sheets for the different categories of student performance data will be stored.

Mongoose:

Utilized as an Address Information Modeling (ODM) library for MongoDB in Node.js. Mongoose gives an arranged way to characterize plans, perform CRUD operations, and maintain information underwriting.

bcrypt:

Encourages secure watchword hashing and affirmation. bcrypt ensures that client passwords are safely put truant interior the database, overhaulin application security.

C. Languages

JavaScript : JavaScript is a versatile programming language that enables the interactive web experiences we encounter every day. From big websites to powerful web applications.

TypeScript : TypeScript is a superset of statically typed JavaScript that adds powerful features that improve developer productivity and code quality. TypeScript was designed to solve some of the inherent challenges of JavaScript, especially its dynamic and loose nature.

D. Parsing Data

PapaParse Library:

Orchestrates for parsing Outperform want sheets containing marks traded by teachers. Papa Parse alters the parsing handle, changing over CSV and Surpass desires records into usable data structures that can be organized and put inside the database.

E. Authorization and Authentication

JWT (JSON Web Tokens):

Executed for client authentication and authorization. JWTs are utilized to safely transmit data between the frontend and backend, guaranteeing that affirmed clients can get to their particular dashboards and information.

F. Extra Contraptions and libraries

Webpack:

Utilized for bundling and overseeing frontend resources such as JavaScript records, stylesheets, and pictures. Webpack streamlines the progress and gets prepared by optimizing code and advancing execution.

Axios (or fetch API):

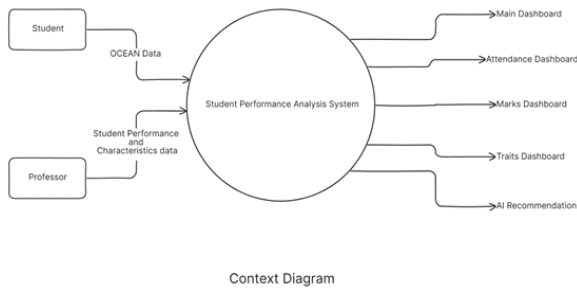
Utilized for making HTTP requests from the frontend to the backend server. Axios streamlines the technique of sending nonconcurrent requests and overseeing with reactions.

This tech stack combines competent frontend and backend improvements, alongside TypeScript and JavaScript, to create a mind blowing web application able of safely overseeing client data, embedding Power BI dashboards, and enabling dependable communication between faculty and the students

VIII. PROJECT FLOW DIAGRAM

The Project's goal is to utilize AI and data analysis to generate recommendations based on their academic performance and personality traits which can help students get a better understanding of their academic status.

It focuses on the Holistic assessment of the student by considering factors like attendance, marks, extracurricular activities, skills and personality traits



Context Diagram
 Fig. 4. Context Diagram

Fig-1 illustrates the high-level view of the system. The professor uses the system to upload the student’s academic performance which inserts the data directly into the MongoDB Database which is picked up by Power BI to generate dashboards for the users.

The Student uses the system to see their academic progress and also they can take a questionnaire that inserts the personality traits of the student into the database.

Fig - 2 gives an overall view of the system functionalities. It shows the relationship between different modules of the system. By viewing the use case diagram, the use of the system can be demonstrated. The users of the system access the system modules according to the privileges provided to them by the administrator.

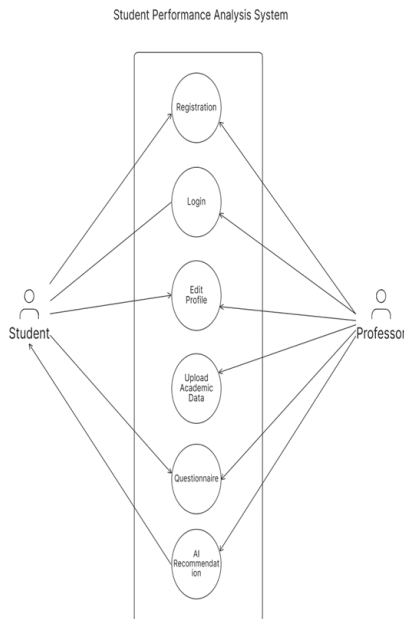


Fig. 5. Use Case Diagram

IX. IMPLEMENTATION DETAILS

A. Authentication System

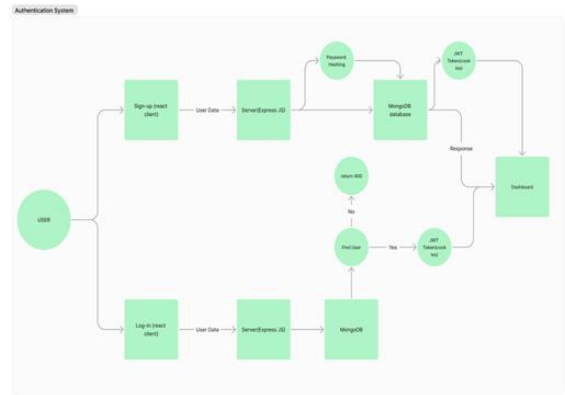


Fig. 6. Authentication System

Fig - 3 shows the architecture of the user authentication system.

This Authentication system utilizes JWT and HTTP-only cookies to achieve a secure and efficient user authentication system.

JWT - JWT stands for JSON Web Token. JWT generates a token by using the user’s data and some complex signing algorithms. This token can then be verified by using JWT.verify() in node js which gives us back the user’s data and authenticity.

HTTP-only Cookies - Cookies are a way of storing data in the browser that can be accessed anytime by the developer by running any kind of script in a web-based programming language.

If they are accessible then there is always a threat of pushing malicious scripts into the systems and breaking the system, that is where HTTP-only cookies come into the picture as they cannot be accessed by scripts, they can only be accessed by HTTP requests.

Working - The user enters credentials into the login form and hits the submit button which sends a POST request to the express.js backend server that receives the form data from the client then the user and the password are verified after that a JWT token is created by user’s data and the token is sent to the client as an HTTP only cookie and set in the browser.

After this process, the user is redirected to the dashboards and whenever the user visits again, if the cookie exists in the browser it is sent to the server in the initial request to verify the user.

If the user is verified then only they can access the application or else they are redirected to the landing page.

Verification logic is done by the verification middleware which also ensures that only professors can access their privileges and not the students.

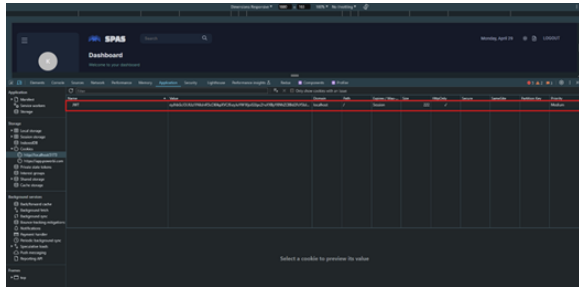


Fig. 7. JWT Cookie

B. OCEAN Traits

The [6] OCEAN traits, also called the Big Five personality traits, is a widely recognized framework used to describe and analyze human personality. Each letter in "OCEAN" represents one of the 5 essential dimensions of personality:

Openness to Experience: This trait displays a person's inclination closer to curiosity, creativity, and receptiveness to new thoughts and studies. People high in openness tend to be creative, adventurous, and open-minded, whilst those low in openness may be more traditional and proof against trade.

Conscientiousness: Conscientiousness encompasses developments that include business enterprise, diligence, and self-discipline. Individuals excessive in conscientiousness are frequently prepared, element-oriented, and dependable, whilst those low in conscientiousness can also conflict with impulsivity, disorganization, and shortage of follow-via.

Extraversion: Extraversion refers to at least one's stage of sociability, assertiveness, and electricity in social conditions. Extraverted people are outgoing, talkative,

and lively, thriving in social settings and searching for stimulation from outside assets. In contrast, introverted individuals tend to be reserved, and reflective, and prefer quieter, more solitary sports.

Agreeableness: Agreeableness captures the diploma to which a man or woman is cooperative, empathetic, and compassionate in the direction of others. People high in agreeableness are typically heated, trusting, and accommodating, fostering harmonious relationships and prioritizing the wishes of others. Those low in agreeableness may additionally showcase extra aggressive or skeptical inclinations and can be much less involved with interpersonal concord.

Neuroticism (or Emotional Stability): Neuroticism reflects the tendency to experience poor emotions together with tension, despair, and vulnerability to strain. Individuals excessive in neuroticism can be liable to mood swings, worry, and self-doubt, even as the ones low in neuroticism tend to be emotionally resilient, calm, and stable inside the face of adversity.

The OCEAN traits give a comprehensive framework for know-how and reading character variations among people. By assessing wherein individuals fall on every of these 5 dimensions, psychologists and researchers can advantage insights into diverse components of conduct, cognition, and interpersonal dynamics.

OCEAN traits are being used in this project as a way to understand the student and assess their behavior and based on that an AI generated recommendation will be generated that will be displayed to the student in order to help the student make decisions for their academic or personal improvement.

The OCEAN data is collected from the students through a questionnaire Fig-0 that they have to take. Which pushes the question data to the user's MongoDB Object and adds new keys to the Object.

C. Databases

MongoDB has been used as the primary database in the entire application, the reason for that being that the type of schema cannot be defined for a lot of tables in this system for example, the academic performance which has to be inserted by the professor can change anytime and the user's traits can also change if the

questionnaire changes hence updating the schema of the table is not possible every time which makes using a NoSQL database more efficient and sensible.

D. Uploading Academic Performances

The AI recommendation works by assessing the academic and personality traits of the student hence the academic performance data has to be entered into the MongoDB database by the professor.

The professor can upload the CSV files containing the different categories of data like marks, attendance etc into the database which will be picked by the AI Model to generate recommendations for the students.

Fig - 0 shows the professor uploading the CSV.

E. AI Integration

Fig-7 Shows the implementation of the AI model integration into the web application

This works by sending a get request to the predict.py python file where all the logic related to the AI model is written. The model generates the recommendation by querying all the necessary data from the database and then provides it to the neural network that generates the actual recommendation which is returned by the Python file to the express backend that is sent to the client via the get request by the client.

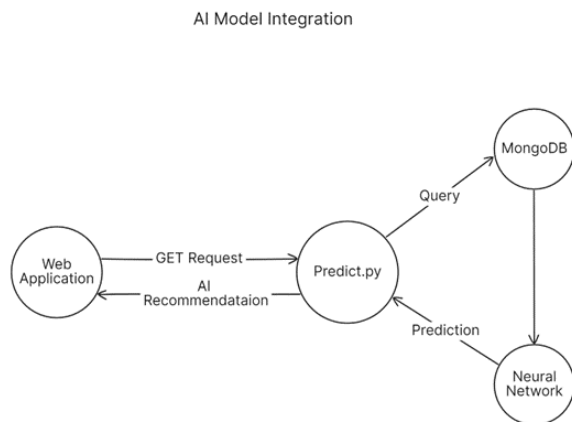


Fig. 8. AI Integration Architecture

X. LIMITATIONS

1. Despite the improvements made in growing our AI-pushed student performance evaluation gadget, numerous barriers warrant attention.

2. Firstly, the effectiveness of the system is predicated heavily at the accuracy and completeness of the facts amassed. Data entry errors, incomplete pupil profiles, and inconsistencies in data formatting could doubtlessly affect the reliability of the insights generated with the aid of the system.
3. Secondly, the generalizability of the AI-generated tips can be constrained by way of personal student characteristics and contextual elements. While the system ambitions to offer personalized guidelines, there can be times where the recommendations aren't relevant or effective for positive college students.
4. Thirdly, the gadget's reliance on technology might also give accessibility demanding situations for users with restricted virtual literacy or access to technology assets. Ensuring equitable access to the system calls for addressing potential limitations to participation and supplying ok assist for customers with numerous wishes.
5. Lastly, the moral implications of the use of AI for student assessment and choice-making ought to be cautiously taken into consideration. Issues associated with information privacy, algorithmic bias, and transparency in choice-making tactics require ongoing interest and oversight to mitigate capability risks and ensure ethical use of the gadget.
6. Despite those boundaries, our system represents a full-size step toward improving instructional excellence and assisting personalized learning reviews. By addressing those challenges and constantly refining our method, we can maximize the advantages of AI-pushed student overall performance analysis at the same time as minimizing potential risks and downsides.

CONCLUSION

In conclusion, the improvement of an AI-driven advanced student performance evaluation system represents a sizable step towards enhancing instructional excellence and customized studying reports. By leveraging contemporary technology and information-driven methodologies, our system aims to deal with the constraints of conventional evaluation strategies and provide educators with complete insights into student development. Through dynamic

dashboards, interactive visuals, and AI-generated suggestions, educators can benefit from a deeper understanding of student overall performance across various dimensions, making an allowance for informed selection-making and tailored getting to know strategies. The integration of authentication, questionnaire functionalities, and records parsing talents creates a sturdy platform for efficient statistics series and analysis.

Furthermore, the use of the OCEAN tendencies framework enables a holistic assessment of college students, considering factors beyond instructional metrics to provide customized suggestions for instructional and personal development. This approach no longer fosters a deeper expertise of student conduct however it also empowers college students to take proactive steps toward their educational desires.

However, it is vital to acknowledge the constraints of our system. While it offers valuable insights and hints, it is predicated closely on records accuracy and completeness, which can be prompted with the aid of factors consisting of records access mistakes or incomplete student profiles. Additionally, the effectiveness of AI-generated hints may also vary based totally on individual student characteristics and contextual factors.

Overall, our studies underscores the significance of integrating AI and records-pushed tactics into instructional practices to support pupil fulfillment and academic excellence. By continuing to refine and enlarge our gadget, we will further beautify its capabilities and make contributions to the continuing evolution of the educational generation.

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