SMARTSKILL MENTOR: INTEGRATING AI FOR PERSONALIZED STUDENT SKILL DEVELOPMENT

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering degree in Computer Science and Engineering

By

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INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **ANALA SHANMUKHA BHANU MOHAN (Reg.No - 41110085) and ANNAPUREDDY JEEVAN REDDY (Reg. No - 41110104)** who carried out the Project entitled "**SMARTSKILL MENTOR: INTEGRATING AI FOR PERSONALIZED STUDENT SKILL DEVELOPMENT**" under my supervision from November 2024 to April 2025.

29/3/25

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DECLARATION

I, **ANALA SHANMUKHA BHANU MOHAN (Reg.No-41110085)** hereby declare that the Project Report entitled **"SMARTSKILL MENTOR: INTEGRATING AI FOR PERSONALIZED STUDENT SKILL DEVELOPMENT"** done by me under the guidance of **Dr. S. PRINCE MARY,M.E., Ph.D.,** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in **Computer Science and Engineering**.

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ABSTRACT

In the modern-day education device, there's a substantial hole among educational understanding and realistic capabilities required in professions. Smart Skill Mentor addresses this problem through assessing college students' academic performance, persona, and pastimes, and creating personalized ability improvement pathways. Using system getting to know algorithms, the platform analyzes scholar facts, predicts applicable talents, and adapts them to industry desires. It additionally consists of real-global troubles solved by means of industry professionals to enhance realistic mastering. Data mining performs a key position within the training area, analyzing huge statistics sets to perceive insights that support higher decision-making. Techniques inclusive of the Random Forest (RF) set of rules assist teachers make informed choices that enhance instructional effects by way of figuring out patterns in pupil information consisting of grades, attendance, and remarks. Data mining additionally permits the advent of character learning plans, making sure that scholars get hold of personalized aid based totally on their specific strengths and weaknesses. By combining information-driven insights with personalized studying and actual-international packages, Smart Skill Mentor helps instructional institutions bridge the gap between idea and practice. This approach will increase student engagement, helps skill improvement, and improves common educational overall performance, thereby better making ready students for enterprise challenges.

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INTRODUCTION

1.1 OVERVIEW

Educational data mining is an emerging field that leverages advanced data mining techniques to analyze educational data collected from various sources such as student records, academic performance metrics, and e-learning databases. Techniques like K-means clustering and Random Forest (RF) are employed to effectively analyze this data, revealing insights through association rules, classification, and clustering. These methods help uncover patterns that describe students' exam performance and other pertinent details. The data undergoes sorting and clustering initially to organize it logically and facilitate deeper analysis, aiding educators in making informed decisions to enhance teaching methods and student outcomes. By employing these data mining techniques, educational institutions can gain valuable insights into student performance and behavior.

For example, K-means clustering can group students based on their performance levels, while RF can identify students who may need additional support by comparing them to their peers. These insights enable educators to tailor their teaching methods, provide targeted interventions, and ultimately improve the overall educational experience. Through the systematic analysis of educational data, institutions can foster a more effective and supportive learning environment, driving better academic outcomes and student development. Following the pandemic and significant changes to the educational system and students' personal life, such as coping with bereavement and social anxiety, dropout rates and academic losses increased, the digital divide, too. Up until now, we have only evaluated a student's academic success based on the mark they received. The existing educational system results in a dreadful experience for more than 50% of students who are not good at what they are doing, according to the current academic performance evaluation method and honest feedback from a student who is average or below average in education. When more than 50% of students lack enthusiasm for studying, the educational system has failed. We considered a strategy where we would evaluate student using the current educational system.

This might make their appraisal of the educational system fairer. The primary goals of this are to raise student general performance and prevent dropouts. The performance of the student is dependent on a number of elements, including their mental state in addition to their grades and academic course work. In light of this, we will carry out a survey in which we will inquire about things like your home, your grades in the 10th and 12th grades, your financial situation, etc. We can determine where the learner is falling behind and where he or she needs to improve by carefully examining these answers. We can help students perform better by adding these answers as an additional feature to our machine learning model.

A system that aims for excellence at all levels and aspects of the students' interest is performance analysis of learning outcomes. This study proposes a comprehensive EDM framework that analyses, predicts, and explains student achievement through the use of a rule-based recommender system. The proposed framework looks at a student's demographics, study-related traits, and psychological aspects in order to obtain as much data as possible from peers, instructors, and parents. The most recent information is gathered via school reports and enquiries, such as student grades, demographic statistics, and elements connected to social and academic life. Attempting to forecast academic success with the highest level of accuracy possible a variety of effective data mining or extracting techniques. The framework is successful at pinpointing the student's areas of weakness.

The modern educational landscape is undergoing a significant transformation, driven by rapid technological advancements and evolving industry demands. Despite the increasing emphasis on higher education, students often graduate with a gap between their academic knowledge and the practical skills required by employers. This disconnect has led to a growing demand for innovative solutions that can bridge the divide between academia and industry, ensuring that students are not only theoretically proficient but also practically skilled and job-ready. Traditional educational systems, while effective in imparting foundational knowledge, often prioritize standardized curricula over individualized learning, leaving students ill-prepared for the unique challenges of the workforce. This mismatch between academic curricula and industry requirements has become a pressing concern, highlighting the need for a more holistic and personalized approach to skill development.

In response to these challenges, a variety of educational platforms have emerged in recent years, aiming to provide more flexible and accessible learning opportunities. Among these, Generic Learning Platforms such as Coursera, Udemy, and Khan Academy have gained widespread popularity for their ability to offer a wide range of courses on diverse topics. These platforms have democratized access to education, allowing students from all walks of life to learn at their own pace and on their own terms. However, while these platforms have made significant strides in making education more accessible, they often fall short in providing truly personalized learning experiences. The courses offered on these platforms are typically standardized, with little to no adaptation based on the individual needs or progress of the learner. For example, a student struggling with a particular concept may not receive the additional support or resources they need to overcome their difficulties, while a student who has already mastered a topic may find themselves bored or disengaged. This lack of personalization limits the effectiveness of these platforms in addressing the unique skill gaps and learning needs of individual students.

Another category of educational platforms that has gained traction in recent years is Adaptive Learning Systems, which aim to provide a more tailored learning experience by adjusting the content and difficulty level based on the learner's performance. Platforms such as Duolingo, DreamBox, and McGraw-Hill ALEKS use algorithms to analyze student data and provide personalized recommendations, ensuring that each learner receives content that is appropriate for their current level of understanding. While these systems represent a significant improvement over generic platforms, they are not without their limitations. For one, the personalization offered by adaptive learning systems is often limited to academic performance, with little to no consideration given to other factors such as personality traits, interests, or career aspirations. Additionally, these systems typically rely on static algorithms that do not adapt to changes in industry trends or the evolving needs of the job market. As a result, while adaptive learning systems can help students improve their academic performance, they may not fully prepare them for the practical challenges they will face in their careers. The limitations of existing educational platforms highlight the need for a more comprehensive and holistic approach to skill development, one that takes into account not only academic performance but also psychological factors and industry demands.

This is where Smart Skill Mentor comes in. Smart Skill Mentor is an AI-powered platform designed to bridge the gap between academia and industry by providing students with personalized skill development roadmaps tailored to their unique needs and aspirations. Unlike generic learning platforms, which offer standardized content, or adaptive learning systems, which focus solely on academic performance, Smart Skill Mentor leverages advanced machine learning algorithms, psychological profiling, and industry data to create a truly personalized learning experience. By analyzing a student's academic performance, personality traits, and interests, the platform is able to identify their strengths and weaknesses, predict suitable skill sets, and recommend learning paths that align with their career goals. This ensures that students not only acquire the knowledge they need to succeed academically but also develop the practical skills and problem-solving abilities required to excel in their chosen careers.

One of the key features that sets Smart Skill Mentor apart from existing platforms is its integration of real-world challenges sourced from industry experts. While traditional educational platforms often focus on theoretical knowledge, Smart Skill Mentor places a strong emphasis on practical learning, providing students with opportunities to apply their skills to real-world problems. For example, a student studying data science may be given a project that involves analyzing a real dataset from a company, while a student interested in marketing may be tasked with developing a campaign for a real product. These challenges not only help students develop practical skills but also give them a taste of what it is like to work in their chosen field, preparing them for the challenges they will face in their careers. By combining theoretical knowledge with practical experience, Smart Skill Mentor ensures that students are well-equipped to meet the demands of the modern workforce.

Another important feature of Smart Skill Mentor is its ability to provide dynamic updates to learning paths based on student progress and industry trends. Unlike traditional educational platforms, which often rely on static content, Smart Skill Mentor uses reinforcement learning algorithms to continuously analyze student data and adjust recommendations accordingly. For example, if a student demonstrates a strong aptitude for a particular skill, the platform may recommend more advanced topics or projects to further develop their expertise. Conversely, if a student struggles with a particular concept, the platform may provide additional resources or support to help them overcome their difficulties. This dynamic approach ensures that students are

always learning at the right level and pace, maximizing their potential and keeping them engaged throughout their learning journey.

In addition to its focus on personalization and practical learning, Smart Skill Mentor also places a strong emphasis on industry alignment, ensuring that the skills students develop are relevant to the current job market. The platform achieves this by continuously analyzing industry trends and incorporating them into its recommendations. For example, if there is a growing demand for data analysts in the job market, the platform may recommend that students with an interest in data science focus on developing skills in data analysis and visualization. By aligning its recommendations with industry demands, Smart Skill Mentor ensures that students are not only well-prepared for their careers but also have a competitive edge in the job market.

The development of Smart Skill Mentor represents a significant step forward in the field of education, offering a comprehensive and holistic approach to skill development that addresses the limitations of existing platforms. By leveraging advanced AI technologies, psychological profiling, and industry data, the platform provides students with personalized learning experiences that are tailored to their unique needs and aspirations. Its integration of real-world challenges and dynamic updates ensures that students not only acquire the knowledge they need to succeed academically but also develop the practical skills and problem-solving abilities required to excel in their careers. As industries continue to evolve and the demand for skilled workers grows, platforms like Smart Skill Mentor will play an increasingly important role in preparing students for the challenges of the modern workforce.

CHAPTER 2

LITERATURE SURVEY

Literature survey is the most important step in software development process. Before developing the tool it is necessary to determine the time factor, economy and company strength. Once these things are satisfied, then the next step is to determine which operating system and language can be used for developing the tool. Once the programmers start building the tool the programmers need lot of external support. This support can be obtained from senior programmers, from book or from websites. Before building the system the above consideration are taken into account for developing the proposed system. The major part of the project development sector considers and fully survey all the required needs for developing the project.

For every project Literature survey is the most important sector in software development process. Before developing the tools and the associated designing it is necessary to determine and survey the time factor, resource requirement, man power, economy, and company strength. Once these things are satisfied and fully surveyed, then the next step is to determine about the software specifications in the respective system such as what type of operating system the project would require, and what are all the necessary software are needed to proceed with the next step such as developing the tools, and the associated operations. By conducting a literature survey, developers can gain insights into the strengths and weaknesses of current solutions, identify best practices, and determine the most suitable technologies and approaches for their project. This process not only helps in optimizing time, resources, and costs but also ensures that the final product is aligned with industry standards and user needs. an AI-powered platform like Smart Skill Mentor, the literature survey plays a pivotal role in understanding how artificial intelligence, personalized learning, and industry-aligned skill development have been addressed in existing systems. It also highlights the limitations of current solutions, such as the lack of psychological profiling, real-world problem integration, and dynamic adaptability, which the proposed system aims to overcome. By building on the findings of previous research and incorporating the latest advancements in AI and education technology, the literature survey provides a foundation for the development of a transformative tool that bridges the gap between academia and industry.

Integrating Artificial Intelligence into Creativity Education: Developing a Creative Problem-Solving Course for Higher Education by

Author/ Year : Selma Dawani/2023

Integrating Artificial Intelligence into Creativity Education: Developing a Creative Problem-Solving Course for Higher Education This project aims to develop an introductory college course that integrates Artificial Intelligence (AI) to enhance the Creative Problem Solving (CPS) process. Drawing on best practices for teaching CPS and the latest research of AI, the project outcomes are prototypes of a Master Course Development Document, Student Syllabus, and Lesson Plan with accompanying PowerPoint slides. The course will equip students with the knowledge and skills to apply AI techniques to the CPS process.

Education 4.0 and 5.0: integrating Articial Intelligence (AI) for personalized and adaptive learning

Author/ Year : Jayesh Rane/2024

This research paper explores how the integration of Articial Intelligence (AI) in the education sector is bringing about transformative changes, particularly within the frameworks of Education 4.0 and 5.0. In response to the evolving technological landscape, education is undergoing a shift to address the challenges of the 21st century, moving away from traditional models to embrace more personalized and adaptive approaches. Education 4.0 represents a signicant shift where technology, notably AI, is harnessed to enhance the learning experience.

Artificial Intelligence in Education: AIEd for Personalised Learning Pathways

Author/Year: Dmitry Gura/2022

Artificial intelligence is the driving force of change focusing on the needs and demands of the student. The research explores Artificial Intelligence in Education (AIEd) for building personalised learning systems for students. The research investigates and proposes a framework for AIEd: social networking sites and chatbots, expert systems for education, intelligent mentors and agents, machine learning, personalised educational systems and virtual educational environments

Collaborative learning and skill development for educational growth of artificial intelligence: A systematic review

Author: Andres F. Mena-Guacas

Year : 2023

The diversity of topics in education makes it difficult for artificial intelligence (AI) to address them all in depth. Therefore, guiding to focus efforts on specific issues is essential. The analysis of competency development by fostering collaboration should be one of them because competencies are the way to validate that the educational exercise has been successful and because collaboration has proven to be one of the most effective strategies to improve performance outcomes

Empowering Soft Skills through Artificial Intelligence and Personalised Mentoring

Author/Year: Pablo González-Rico/2024

At present, the integration of technology into education has generated a significant change in the way students access knowledge and develop skills. The availability of digital tools and online platforms has democratised access to information, allowing students to learn from anywhere and at any time. This article focuses on how the combination of artificial intelligence digital tools, such as ChatGPT, with one-to-one tutoring affects the development of soft skills in higher education students. A total of 182 university students participated in the study, divided into two groups.

Predicting Student Academic Performance

Engineering schools worldwide have a relatively high attrition rate. Typically, about 35% of the first-year students in various engineering programs do not make it to the second year. Of the remaining students, quite often they drop out or fail in their second or third year of studies. The purpose of this investigation is to identify the factors that serve as good indicators of whether a student will drop out or fail the program. In order to establish early warning indicators, principal component analysis is used to analyze, in the first instance, first-year engineering student academic records. These performance predictors, if identified, can then be used effectively to formulate corrective action plans to improve the attrition rate.

Data Mining Approach For Predicting Student Performance

This work proposes a novel approach - personalized forecasting - to take into account the sequential effect in predicting student performance (PSP). Instead of using all historical data as other methods in PSP, the proposed methods only use the information of the individual students for forecasting his/her own performance. Moreover, these methods also encode the "student effect" (e.g. how good/clever a student is, in performing the tasks) and "task effect" (e.g. how difficult/easy the task is) into the models. Experimental results show that the proposed methods perform nicely and much faster than the other state-of-the-art methods in PSP.

Data Mining: A prediction of performer or underperformer using classification

Now a day's students have a large set of data having precious information hidden. Data mining technique can help to find this hidden information. In this paper, data mining techniques name Byes classification method is used on these data to help an institution. Institutions can find those students who are consistently perform well. This study will help to institution reduce the drop put ratio to a significant level and improve the performance level of the institution.

A novel approach for upgrading Indian education by using data mining techniques

Education is the backbone of all developing countries. Upgrading of the education system, upgrades the country to the world top ranking level. One of the major problems that the education system facing is predicting the behaviour of students from large database. This paper focus on upgrading Indian education system by using one of the techniques in Data mining namely clustering. Cluster analysis solves the given data into some meaningful groups. Normally the performances of the students can be classified into different patterns as normal, average and below average. In this paper we attempt to analyze student's data in different angle beyond the above indicated patterns through newly proposed UCAM (Unique clustering with Affinity Measures) clustering algorithm.

A Review on Data Mining techniques and factors used in Educational Data Mining to predict student amelioration

Educational Data Mining (EDM) is an interdisciplinary ingenuous research area that handles the development of methods to explore data arising in a scholastic fields. Computational approaches used by EDM is to examine scholastic data in order to study educational questions. As a result, it provides intrinsic knowledge of teaching and learning process for effective education planning. This paper conducts a comprehensive study on the recent and relevant studies put through in this field to date. The study focuses on methods of analysing educational data to develop models for improving academic performances and improving institutional effectiveness. This paper accumulates and relegates literature, identifies consequential work and mediates it to computing educators and professional bodies. We identify research that gives well-fortified advise to amend edifying and invigorate the more impuissant segment students in the institution. The results of these studies give insight into techniques for ameliorating pedagogical process, presaging student performance, compare the precision of data mining algorithms, and demonstrate the maturity of open source implements.

2.1 REVIEW ON EXISTING SYSTEM

In the existing system, teachers predict a student's character manually. When parents visit the college and ask about their child's behavior, teachers often rely solely on the student's marks to provide feedback. However, this method is limited because it only considers academic performance and doesn't account for the student's involvement in various other activities. This traditional approach overlooks the student's multi-faceted personality and potential in areas beyond academics. As a result, teachers might miss important aspects of the student's behavior, interests, and skills. A more comprehensive system that includes multiple factors such as extracurricular activities, attendance, and feedback from various sources would provide a better understanding of the student's character and overall development.

OBJECTIVE

- **Develop an AI-Based Evaluation System:**
  To design and implement an AI-driven system that evaluates student performance using a comprehensive range of data, including academic records, extracurricular activities, attendance, and behavioral factors.
- **Enhance Prediction Accuracy with Machine Learning:**
  To leverage machine learning algorithms, specifically Support Vector Machine (SVM) and Random Forest, to accurately predict students' overall performance, considering both academic achievements and non-academic talents.
- **Create Personalized Learning Roadmaps:**
  To generate customized learning pathways for students based on their predicted performance and identified strengths and weaknesses, thereby supporting personalized education.
- **Integrate Data from Diverse Sources:**
  To collect and process data from multiple sources such as academic scores, participation in extracurricular activities, attendance records, and behavioral assessments, ensuring a holistic evaluation of student performance.
- **Address Limitations of Traditional Evaluation Methods:**
  To overcome the shortcomings of conventional student evaluation systems that primarily focus on academic marks by incorporating additional metrics, including student discipline and extracurricular talents, thus providing a more comprehensive and fair assessment of each student.

- **Implement SVM and Random Forest for Balanced Evaluation:**
  To apply the SVM algorithm alongside Random Forest to ensure that students who excel in extracurricular activities and maintain good discipline are recognized as good students, even if their academic marks are lower, thus promoting a balanced and fair evaluation.
- **Improve Student Engagement and Outcomes:**
  To enhance student engagement by offering personalized feedback and learning strategies that align with their individual skills and needs, ultimately improving overall educational outcomes.

2.2 INFERENCE AND CHALLENGES IN EXISTING SYSTEM

INFERENCE

The traditional student evaluation systems are heavily reliant on academic performance, typically measured through grades and test scores. However, these systems often fail to recognize the multifaceted nature of student abilities. Students who may not excel in academics but demonstrate exceptional talent in extracurricular activities, maintain good discipline, and possess strong interpersonal skills are often undervalued. The inference drawn from this observation is that a more holistic approach to student evaluation is needed—one that encompasses both academic and non-academic factors to provide a fair and comprehensive assessment of a student's overall potential.

CHALLENGES IN EXISTING SYSTEM

Overemphasis on Academic Marks:

Traditional systems prioritize academic scores as the primary measure of a student's capability, often neglecting other critical aspects such as creativity, leadership, discipline, and extracurricular talents.

Limited Data Integration:

Current evaluation methods typically focus on a narrow range of data points, mostly related to academic performance. This limited scope results in a one-dimensional view of students' abilities, ignoring important factors like behavior, emotional well-being, and non-academic achievements.

Inability to Provide Personalized Feedback:

Existing systems lack the ability to analyze and interpret a student's unique strengths and weaknesses comprehensively. As a result, they fail to offer personalized learning pathways or feedback that could help students improve in areas beyond academics.

Bias Towards Academically Inclined Students:

The current approach inherently favors students who perform well academically, while those who may excel in other areas but struggle with traditional academic subjects are often labeled as underperformers. This bias can negatively impact students' self-esteem and motivation.

Lack of Predictive Capabilities:

Traditional evaluation systems do not typically utilize advanced predictive algorithms like SVM or Random Forest. As a result, they cannot forecast a student's future performance or potential based on a broader set of data, limiting the ability to intervene early with targeted support.

Neglect of Emotional and Behavioral Factors:

Emotional intelligence, discipline, and behavior are critical components of a student's overall development. However, existing systems often overlook these aspects, leading to an incomplete assessment of a student's true potential.

Limited Use of Machine Learning in Student Performance Prediction:

Despite the potential of machine learning to enhance student performance prediction, most existing approaches in the literature rely solely on analyzing student datasets without applying machine learning techniques. This represents a significant gap, as machine learning algorithms like SVM and Random Forest can provide more accurate and insightful predictions, leading to better-informed educational interventions.It is found from the literature survey that student performance prediction is done using the dataset of the student and by taking student data but not using machine learning.

CHAPTER 3

REQUIREMENT ANALYSIS

3.1 NECESSITY & FEASIBILITY ANALYSIS OF PROPOSED SYSTEM

The traditional educational system has long relied on academic performance, primarily measured through marks and grades, as the sole indicator of a student's potential and capabilities. While this approach has been widely adopted due to its simplicity and ease of implementation, it is inherently flawed and limited in its ability to capture the true essence of a student's abilities. Academic marks, though important, do not provide a holistic view of a student's overall potential, as they fail to account for other critical factors such as creativity, leadership, discipline, extracurricular achievements, and problem-solving skills. For instance, a student who may not excel in academics but demonstrates exceptional talent in sports, arts, or leadership roles is often unfairly judged as underperforming. Such students, despite being well-rounded and capable, are frequently labeled as "average" or "needs improvement" solely because their academic performance does not align with conventional benchmarks. This narrow focus on academic marks not only undermines the diverse talents of students but also perpetuates a system that fails to recognize and nurture their true potential.

The limitations of traditional evaluation methods highlight the necessity for a more comprehensive and inclusive approach to assessing student behavior and potential. The proposed system, Smart Skill Mentor, addresses this critical gap by leveraging advanced machine learning algorithms, specifically Support Vector Machine (SVM) and Random Forest, to provide a more balanced and accurate evaluation of students. Unlike traditional systems, which rely heavily on academic performance, the proposed system considers a wide range of factors, including academic records, psychological traits, extracurricular achievements, disciplinary behavior, and leadership qualities. By incorporating these diverse attributes, the system ensures that students are evaluated holistically, rather than being judged solely on their academic marks. This approach not only provides a fairer assessment but also promotes a more inclusive educational environment where students are recognized for their unique strengths and talents.

The necessity of the proposed system is further underscored by the growing demand for personalized and adaptive learning solutions in the education sector. In today's rapidly evolving world, where industries are increasingly seeking candidates with a diverse skill set and practical problem-solving abilities, traditional educational systems are struggling to keep pace. The proposed system bridges this gap by providing personalized skill development roadmaps tailored to each student's unique needs and aspirations. By integrating advanced machine learning algorithms, the system can analyze vast amounts of data, identify skill gaps, and recommend targeted learning paths that align with industry demands. This not only enhances the employability of students but also ensures that they are well-prepared to meet the challenges of the modern workforce.

In addition to its necessity, the feasibility of the proposed system is a critical consideration. The system is designed to be cost-effective, leveraging existing infrastructure and requiring minimal additional investment. The use of open-source machine learning frameworks and tools, such as Scikit-learn for implementing SVM and Random Forest, significantly reduces development costs. Furthermore, the system's modular architecture allows for easy integration with existing educational platforms, such as Learning Management Systems (LMS) and Massive Open Online Courses (MOOCs), minimizing the need for extensive infrastructure upgrades. The long-term benefits of the proposed system, including improved student outcomes, enhanced employability, and better alignment with industry demands, far outweigh the initial costs of implementation.

The proposed system's feasibility is further supported by the scalability and efficiency of the machine learning algorithms it employs. SVM and Random Forest are well-suited for processing large datasets, making them ideal for analyzing the diverse and complex data required for holistic student evaluation. SVM, known for its ability to handle high-dimensional data and perform well in classification tasks, is particularly effective in identifying patterns and relationships between academic performance and non-academic attributes. Random Forest, on the other hand, excels in handling heterogeneous data and providing robust predictions, making it an excellent choice for assessing a student's overall potential.

Moreover, the proposed system's ability to integrate real-world challenges and industry trends further enhances its feasibility and relevance. By collaborating with industry experts and incorporating real-world problem-solving tasks into the learning process, the system ensures that students gain practical experience and develop skills that are directly applicable to their chosen careers. This not only enhances the system's effectiveness but also increases its appeal to educational institutions and employers alike.

3.2 SYSTEM REQUIREMENTS:

To ensure optimal performance and versatility, the software should be compatible with Windows, Linux, and MacOS operating systems as shown in the Fig 4.1. Development will primarily use Python, leveraging libraries such as Scikit-learn, Pandas, and NumPy for machine learning and data preprocessing. JavaScript is essential for creating interactive web interfaces, if applicable. A development environment utilizing Jupyter Notebook and IDEs like PyCharm or Visual Studio Code will support effective coding and debugging. The system requires a robust DBMS, either MySQL or PostgreSQL, for managing data. Machine learning tasks will benefit from Scikit-learn, with TensorFlow or PyTorch recommended for advanced models. Web applications will use Django or Flask. Visualization needs will be addressed with Matplotlib and Seaborn, with optional integration of Tableau or Power BI for advanced insights. Version control will be managed with Git, and package management will be streamlined using Anaconda and Virtualenv. Hardware requirements include a minimum of 8 GB RAM (16 GB recommended), an SSD with at least 256 GB (512 GB recommended), and a dedicated GPU for intensive tasks. A reliable network connection and high-resolution monitor(s) will further enhance development and analysis efficiency.

HARDWARE REQUIREMENTS:

Processor (CPU):

Minimum: Intel Core i5 or equivalent (or AMD Ryzen 5)

Recommended: Intel Core i7 or (or AMD Ryzen 7)

A faster processor will speed up data processing, model training, and general software operations. Machine learning tasks, especially with larger datasets or more complex models, benefit significantly from a powerful CPU.

Memory (RAM):

Minimum: 8 GB

Recommended: 16 GB or more

Sufficient RAM is crucial for handling large datasets, especially when performing data analysis and training machine learning models. More RAM allows for smoother multitasking and better performance with large-scale data operations.

Storage:

Minimum: 256 GB SSD

Recommended: 512 GB SSD or larger

SSDs are preferred over HDDs for faster read/write speeds, which is important for accessing and processing large datasets quickly. Having ample storage is also important for saving various versions of models, datasets, and other project-related files.

Graphics Processing Unit (GPU):

Minimum: Integrated GPU (e.g., Intel HD Graphics)

Recommended: Dedicated GPU (e.g., NVIDIA GeForce GTX 1660 or better)

While not always necessary for basic machine learning tasks, a dedicated GPU can significantly speed up training times for deep learning models using TensorFlow or PyTorch. For complex or large-scale models, a GPU can make a substantial difference.

Networking:

Minimum: Standard Ethernet or Wi-Fi connection

Recommended: Gigabit Ethernet or high-speed Wi-Fi (e.g., Wi-Fi 6)

A reliable and fast network connection is essential for downloading datasets, collaborating with others, and accessing cloud resources if needed. For web-based components or collaborative work, a stable network is important.

Monitor:

Minimum: 1080p resolution

Recommended: 4K resolution or dual monitors

A higher resolution monitor or multiple monitors can improve productivity by allowing more workspace for coding, data visualization, and documentation simultaneously.

Additional Peripherals:

Keyboard and Mouse: Comfortable and reliable input devices.

Printer: For printing reports or documentation, if needed.

Backup Drives: External storage or cloud backup solutions for securing project data.

SOFTWARE REQUIREMENTS:

Windows/Linux/MacOS: The software should be compatible across different operating systems to ensure accessibility for all users. Windows is commonly used in educational institutions, but support for Linux and MacOS will cater to a wider audience.

Python: Essential for implementing machine learning algorithms like Random Forest and for data preprocessing tasks. Python's extensive libraries, such as Scikit-learn, Pandas, and NumPy, are crucial for this project's data analysis and model building.

JavaScript: If your system includes a web-based user interface, JavaScript will be necessary for front-end development to create interactive elements for users.

Development Environment:

Jupyter Notebook: Ideal for developing and testing machine learning models. It allows for easy visualization of data and model results, making it easier to interpret and tweak algorithms.

React: React is a powerful JavaScript library used for building dynamic and responsive user interfaces. It enables the creation of interactive and reusable components, ensuring a seamless and engaging experience for students and educators. React's virtual DOM ensures high performance, even with complex data updates, making it ideal for real-time applications. Its component-based architecture simplifies development and maintenance, allowing for scalable and modular design.

MongoDB

MongoDB is a NoSQL database that provides flexibility and scalability for storing and managing student data, performance records, and other related information. Its document-oriented structure allows for efficient handling of unstructured or semi-structured data, making it suitable for diverse educational datasets. MongoDB's horizontal scaling capabilities ensure that the system can handle growing data demands as the user base expands.

Scikit-learn: Essential for implementing and fine-tuning the Random Forest algorithm, along with other machine learning models that might be explored during the project.

TensorFlow/PyTorch: If the project expands to include deep learning techniques for more advanced analytics, TensorFlow or PyTorch will be necessary.

Matplotlib/Seaborn: For generating visual reports and insights from the data, these Python libraries will be crucial for creating graphs and charts.

Tableau/Power BI: If more sophisticated data visualization is needed, tools like Tableau or Power BI can be integrated to produce interactive dashboards.

Machine Learning Libraries (Scikit-learn, TensorFlow)

Scikit-learn is essential for implementing machine learning algorithms like Random Forest, enabling accurate predictions and insights into student performance. TensorFlow, on the other hand, is used for more advanced analytics and deep learning tasks, providing tools for building and training complex neural networks. These libraries ensure efficient data processing, model training, and real-time updates, making the system both powerful and adaptable to evolving educational needs.

Git: For tracking changes in the software development process, collaborating with team members, and managing different versions of the code.

Other Utilities:

CHAPTER 4
DESCRIPTION OF PROPOSED SYSTEM

The proposed system, Smart Skill Mentor, is designed to revolutionize the way student performance and behavior are evaluated in the educational sector. Traditional methods of assessing students, which rely heavily on academic marks, often fail to capture the full spectrum of a student's abilities and potential. This limitation has led to a growing need for a more comprehensive and data-driven approach to student evaluation. The proposed system addresses this need by leveraging educational data mining (EDM) techniques to analyze a wide range of student data, including academic performance, attendance, extracurricular activities, psychological traits, and behavioral patterns. By using advanced machine learning algorithms such as Random Forest (RF) and Naïve Bayes, the system aims to provide a holistic evaluation of students, enabling educators to identify both high-performing students and those who may require additional support or intervention.

The system's primary objective is to develop a trust model that can serve as a strategic management tool for educational institutions. By mining and analyzing educational data, the system provides actionable insights into student performance and behavior, helping institutions make informed decisions about curriculum design, teaching methodologies, and student support programs. The use of data mining techniques allows the system to uncover hidden patterns and relationships in the data, enabling a more nuanced understanding of the factors that influence student success. For example, the system can identify correlations between attendance records and academic performance, or between participation in extracurricular activities and emotional well-being. These insights can then be used to tailor educational strategies to the needs of individual students, ensuring that no student is left behind.

ADVANTAGES OF PROPOSED SYSTEM

- Educational database contain the useful information for Evaluating Students.
- The data mining techniques are more helpful in classifying educational database and help us in evaluating the performance and undesirable behavior of a student.

- The insights gained from Random Forest analysis can help educators design more effective support strategies, addressing both academic and non-academic factors that influence student outcomes.

4.1 SELECTED METHODOLOGIES

In this chapter, we detail the methodologies employed for predicting student performance using advanced machine learning techniques. The focus is on utilizing Random Forest (RF) due to its effectiveness in handling complex datasets and providing valuable insights into educational outcomes.

Overview of Random Forest

Random Forest (RF) is an ensemble learning method that combines multiple decision trees to improve predictive accuracy and robustness. This technique is particularly well-suited for analyzing educational data due to its ability to handle large datasets with diverse features and to provide insights into complex, non-linear relationships.

Random Forest in Educational Data Mining

Enhanced Predictive Accuracy: RF aggregates predictions from multiple decision trees, which helps in making more accurate predictions about student performance. This is crucial for identifying students who may require additional support or intervention.

Feature Importance: RF can assess the importance of various features, such as academic performance metrics, emotional state, and involvement in extracurricular activities. This aligns with the goal of using comprehensive data to understand and predict student performance more effectively.

Handling Missing Data: Given the varied sources of educational data and the challenges of incomplete records, RF's ability to manage missing values is particularly beneficial.

Non-Linear Relationships: RF's capability to model complex relationships helps in capturing the intricacies of student performance, which may be influenced by a range of factors beyond just academic grades.

Implementation of Random Forest for Student Performance Prediction

The implementation of RF for predicting student performance involves several key steps, tailored to the context of educational data mining:

Data Collection:

Collect data from multiple sources, including student records, academic performance metrics, emotional and psychological assessments, and extracurricular activities. This comprehensive data collection supports the goal of evaluating student performance from a holistic perspective, as suggested by the provided content.

Data Preprocessing:

Clean and preprocess the data to handle missing values, encode categorical variables, and normalize continuous variables. This step ensures that the data is ready for effective analysis, which is critical for accurate performance prediction.

Feature Selection:

Identify and select features that are most relevant to predicting student performance. This includes academic metrics, emotional state, and other relevant factors, which aligns with the approach of incorporating additional information to evaluate students.

Model Training:

Train the Random Forest model on the prepared dataset, optimizing parameters to enhance performance. This involves using the data to build and refine the model, ensuring it can predict student outcomes accurately.

Model Evaluation:

Assess the performance of the RF model using various metrics such as accuracy, precision, recall, and F1-score. This evaluation helps in determining the effectiveness of the model in predicting student performance and identifying areas for improvement.

Interpretation of Results:

Analyze the results to gain insights into which features most significantly impact student performance. This understanding supports the goal of using educational data mining to tailor teaching methods and provide targeted interventions.

Benefits and Applications

Improved Accuracy and Insight: By analyzing a wide range of factors, RF provides more accurate predictions and deeper insights into student performance, addressing the limitations of traditional methods that focus solely on academic grades.

Informed Interventions: The insights gained from RF analysis can help educators design more effective support strategies, addressing both academic and non-academic factors influencing student outcomes.

Holistic Evaluation: Integrating diverse data sources through RF allows for a more comprehensive evaluation of student performance, which aligns with the proposed strategy of considering emotional state and interests alongside academic performance.

4.2 SYSTEM ARCHITECTURE

The system architecture for predicting student performance integrates machine learning techniques to classify students as "Good" or "Bad" performers .The process begins with a student dataset, which undergoes pre-processing to clean and select relevant features. The refined data is then fed into two machine learning models: Random Forest (RF) and Naïve Bayes, which are trained to predict student performance. The predictions are analyzed and visualized using performance metrics and graphs, providing insights into the effectiveness of the models and the factors influencing student success. The process begins with a student dataset, which undergoes pre-processing to clean and select relevant features. The refined data is then fed into two machine learning models: Random Forest (RF) and Naïve Bayes, which are trained to predict student performance as shown in fig 4.1. The predictions are analyzed and visualized using performance metrics and graphs, providing insights into the effectiveness of the models and the factors influencing student success.

Student Dataset:

The dataset includes various attributes of students, such as academic scores, attendance records, and personal demographicsas. Serves as the foundational data for training and testing the machine learning models.

Pre-processing:

This involves removing or correcting inaccurate, incomplete, or irrelevant parts of the data to ensure quality.Also identifying and selecting the most important features from the dataset that contribute significantly to predicting student performance.

RF & Naïve Bayes:

The pre-processed data is used to train the Random Forest and Naïve Bayes models, allowing them to learn patterns that correlate with student performance. These models predict whether a student will perform well or poorly based on the selected features.

Prediction Outcome:

The system makes a binary decision, classifying students into "Good" or "Bad" performance categories and results of the predictions are then categorized and prepared for further analysis.

Performance Analysis & Graph:

The accuracy and effectiveness of the predictions are assessed using performance metrics like accuracy, precision, and recall Visualization the results and performance metrics are visualized in the form of graphs, making it easier to understand and interpret the outcomes.

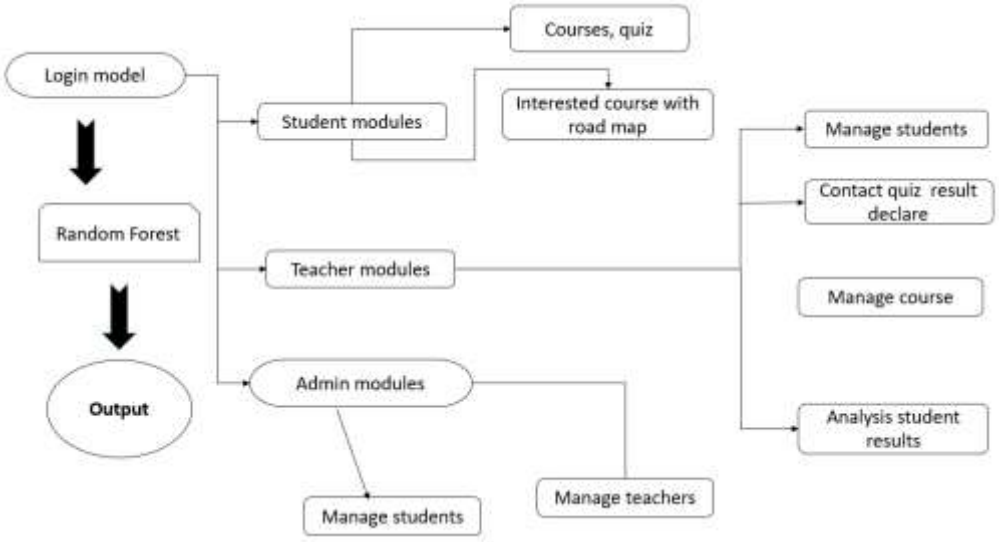

Fig 4.1 : System Architecture

4.3 DETAILED DESCRIPTION OF MODULES AND WORKFLOW

MODULES

- Admin Modules
- Add Student Details
- Data Collection
- Preprocessing
- Model Selection
- Prediction
- Personalized Roadmap Module

MODULES DESCRIPTION

Admin Module

The Admin Module is the central control hub of the system, designed to facilitate seamless management and oversight of the entire student evaluation process. Administrators can use this module to manage user access, configure system settings, and ensure that the system is functioning optimally. This module is responsible for handling tasks such as user authentication, role-based access control, and maintaining the security of the system. Additionally, it allows administrators to monitor the overall system performance, manage data storage, and oversee the integration of various components, such as data collection, preprocessing, and model selection. By providing a user-friendly interface, the Admin Module enables administrators to efficiently manage the system's operations, ensuring that the evaluation process is accurate and up-to-date.

Add Student Details Module

The Add Student Details Module is essential for gathering and inputting student information into the system. This module enables educators to enter data about each student, including academic records and personal demographics. The module supports bulk data entry and allows for the import of student records from existing databases or spreadsheets. This detailed data collection is crucial as it forms the foundation for the machine learning models used in the evaluation process. Accurate and thorough data entry ensures that the system has all the necessary information to make informed predictions about a student's performance and potential.

Data Collection Module

The Data Collection Module is responsible for gathering data from multiple sources to create a holistic view of each student's performance and behavior. This module aggregates information from various inputs, such as academic databases, attendance logs, extracurricular activity records, and behavioral assessments . The data collected is diverse, encompassing both quantitative metrics (like grades and attendance rates) and qualitative inputs .This module also ensures that the data is collected in a consistent format, which is essential for the subsequent preprocessing stage. By integrating data from multiple sources, the system can provide a more comprehensive evaluation of student performance, going beyond just academic marks to include other important aspects of student life.

Preprocessing Module

The Preprocessing Module is a critical component that prepares the raw data collected from various sources for analysis. This module is responsible for cleaning the data by removing inaccuracies, handling missing values, and correcting inconsistencies. It also involves normalizing and encoding the data to ensure that it is in a format suitable for machine learning algorithms. The preprocessing step includes feature selection, where the most relevant attributes are identified and retained for model training. This step is crucial as it enhances the quality and reliability of the data, leading to more accurate predictions. The Preprocessing Module ensures that the data fed into the machine learning models is clean, consistent, and representative of the diverse aspects .

Steps in Preprocessing:

- **Data Integration**

  Merging Data from Multiple Sources: Combine data from various sources such as academic records, attendance logs, extracurricular participation records, and behavioral assessments. This involves resolving any conflicts between datasets and removing redundancies .

- **Data Transformation**

  Scaling and Normalization: Adjust academic scores, attendance percentages, and other numerical features to a common scale. For instance, scale exam scores to a [0, 1] range to ensure that all features contribute equally to the model's predictions.

  Log Transformation: Apply log transformation to skewed distributions of variables such as grades or hours of study to reduce the impact of extreme values and achieve a more normal distribution.

  Polynomial Features: Create new features from existing ones to capture non-linear relationships, such as interaction terms between study hours and extracurricular activities.

- **Dimensionality Reduction**

  Principal Component Analysis (PCA): Reduce the number of features such as various test scores and participation metrics by transforming them into principal components that capture most of the variance. This helps to simplify the model and reduce noise.

  Feature Selection Techniques: Use Recursive Feature Elimination (RFE) or Lasso (L1 regularization) to select the most impactful features.

- **Data Augmentation**

  Synthetic Data Generation: If the dataset is imbalanced (e.g., fewer examples of students with high extracurricular involvement), generate synthetic data to balance the classes using techniques like SMOTE, ensuring a more diverse and representative dataset.

- **Handling Imbalanced Data**

  Resampling Techniques: If there is a class imbalance in performance categories oversample the underrepresented class or undersample the overrepresented class to balance the dataset. Assign higher weights to the minority class during model training to make the model more sensitive to underrepresented categories.

- **Outlier Detection and Treatment**

  Identifying Outliers: Use methods like Z-score or IQR to detect outliers in academic scores or attendance records that could skew the analysis.

  Treatment of Outliers: Decide whether to remove or adjust outliers. For example, set thresholds for grades or attendance and cap extreme values to ensure they do not disproportionately affect model performance.

- **Binning**

  Discretization: Transform continuous variables like test scores into discrete bins (e.g., “Below Average,” “Average,” “Above Average”) to simplify analysis and make the data more interpretable.

- **Data Imputation**

  Advanced Missing Value Imputation: Use methods such as K-Nearest Neighbors (KNN) imputation or Random Forest-based imputation to fill in missing values in academic scores or attendance records, ensuring that the imputed values are realistic and consistent with the data distribution.

- **Encoding Categorical Variables**

  One-Hot Encoding: Convert categorical variables such as grade levels or participation types into binary vectors to include them in the model.

  Label Encoding: Assign integers to ordinal categories such as “Low,” “Medium,” “High” in behavioral assessments.

  Target Encoding: Replace categorical variables like “Extracurricular Activity Type” with the average academic performance for each category, if it improves model performance.

- **Data Partitioning**

  Splitting the Data: Divide the dataset into training, validation, and test sets. For instance, use 70% of the data for training, 15% for validation, and 15% for testing to evaluate the model's performance and ensure it generalizes well to unseen data.

Model Selection Module

The Model Selection Module is where the core of the AI-driven evaluation takes place. This module is designed to select and apply the most appropriate machine learning algorithms to predict student performance. The system primarily employs Random Forest and Naïve Bayes models, chosen for their robustness and ability to handle complex educational datasets. This module allows for the fine-tuning of model parameters to optimize performance and improve predictive accuracy. The selection of the model is based on the specific characteristics of the dataset, ensuring that the model chosen is best suited to capture the nuances of student performance. This module plays a pivotal role in ensuring that the predictions made by the system are both accurate and insightful, providing educators with valuable information to guide their decisions.

Prediction Module

The Prediction Module is where the processed data and selected models come together to generate insights about student performance. Once the model has been trained on the historical data, it can predict future outcomes, such as whether a student is likely to perform well or poorly in the upcoming term. This module classifies students into categories like "Good" or "Bad" performers based on the model's predictions. The output from this module is crucial for identifying students who may need additional support or intervention. By providing early warnings about potential academic or behavioral issues, this module helps educators take proactive measures

Personalized Roadmap Module

The Personalized Roadmap Module is designed to translate the predictions made by the system into actionable educational strategies. This module creates individualized learning plans for students based on their predicted performance and identified strengths and weaknesses. For example, a student who excels in extracurricular activities but struggles academically might receive a personalized plan that includes additional academic support while also encouraging their involvement in non-

academic pursuits. The module uses the insights from the prediction stage to offer tailored recommendations that can help each student reach their full potential. This module is essential for fostering personalized education, enabling educators to provide targeted support that aligns with each student's unique needs and abilities.

- **Next Best Task:** Suggestions on the next task to focus on based on deadlines, priorities, and user progress.
- **Skill Gap Analysis:** Identifies skills where the user may be falling behind, suggesting specific tasks to complete.

4.4 IMPLEMENTATION

The implementation of the Smart Skill Mentor system involves a structured and systematic approach to ensure that the proposed solution is effectively developed, deployed, and integrated into the educational ecosystem. The implementation process is divided into several key phases, each designed to address specific aspects of the system's development and deployment.

Requirement Analysis and Planning:

The first phase involves a thorough analysis of the requirements and objectives of the system. This includes identifying the key stakeholders, such as students, educators, and institutions, and understanding their needs and expectations. A detailed project plan is developed, outlining the scope, timeline, and resources required for the implementation.

System Design and Architecture:

Based on the requirements, the system's architecture is designed, including the data collection module, machine learning models, user interface, and real-world problem repository. The design phase also involves selecting the appropriate technologies and tools, such as Python for machine learning, Scikit-learn for implementing Random Forest and Naïve Bayes algorithms, and a user-friendly dashboard for displaying results and recommendations.

Data Collection and Preprocessing:

The next phase involves collecting data from various sources, including academic records, psychological assessments, and extracurricular activities. The collected data is preprocessed to handle missing values, encode categorical variables, and normalize continuous variables. This ensures that the data is clean, consistent, and ready for analysis.

Model Development and Training:

The machine learning models, including Random Forest and Naïve Bayes, are developed and trained using the preprocessed data. The models are optimized to enhance their predictive accuracy and robustness. This phase also involves feature selection and hyperparameter tuning to ensure that the models perform well on the given dataset.

System Integration and Testing:

Once the models are trained, they are integrated into the system's architecture. The integrated system is thoroughly tested to ensure that all components work together seamlessly. Testing includes unit testing, integration testing, and user acceptance testing to identify and fix any issues or bugs.

Deployment and User Training:

After successful testing, the system is deployed in a real-world educational environment. Educators and students are provided with training and support to help them understand and use the system effectively. This includes workshops, tutorials, and user manuals.

Monitoring and Maintenance:

The final phase involves monitoring the system's performance and making necessary updates and improvements. This includes tracking key performance metrics, such as accuracy, precision, and recall, and incorporating user feedback to enhance the system's functionality and usability.

DATA FLOW DIAGRAM

Data Flow Diagram (DFD) is a two-dimensional diagram that describes how data is processed and transmitted in a system as shown in Fig 4.3. The graphical depiction recognizes each source of data and how it interacts with other data sources to reach a mutual output. In order to draft a data flow diagram one must

- Identify external inputs and outputs
- Determine how the inputs and outputs relate to each other
- Explain with graphics how these connections relate and what they result in.

Role of DFD:

- It is a documentation support which is understood by both programmers and nonprogrammers. As DFD postulates only what processes are accomplished not how they are performed.
- A physical DFD postulates where the data flows and who processes the

data.

- It permits analyst to isolate areas of interest in the organization and study them by examining the data that enter the process and viewing how they are altered when they leave.

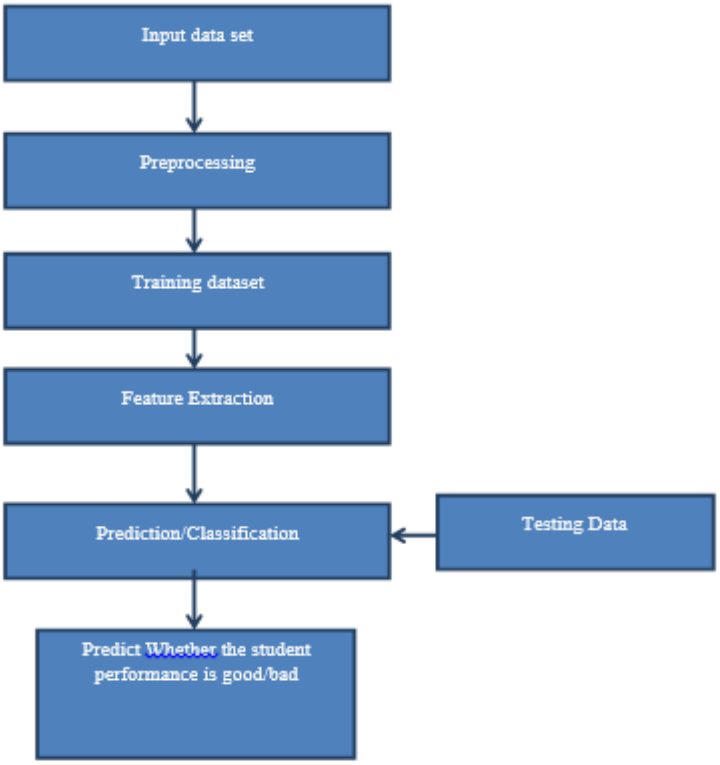

Fig 4.2 : Dataflow Diagram

4.5 FINANCIAL REPORT ON ESTIMATED COSTING

The financial report provides an overview of the estimated costs associated with the development, deployment, and maintenance of the Smart Skill Mentor system. Since the system is currently in the prototype phase and not yet a fully deployed real-time project, the costing is based on hypothetical scenarios and projected requirements. The costs are categorized into several key areas, including personnel, technology, infrastructure, and ongoing maintenance, to provide a realistic estimate of the resources needed for future implementation.The estimated costs for developing the Smart Skill Mentor prototype and provides a projection of the ongoing maintenance costs for future deployment. While the prototype phase involves significant investment in personnel, technology, and infrastructure, the long-term benefits of the system, including improved student outcomes, personalized learning

experiences, and better alignment with industry demands, justify the initial costs. The prototype serves as a proof of concept, demonstrating the system's potential to transform the educational landscape and bridge the gap between academia and industry.

Personnel Costs:

Data Scientists and Machine Learning Engineers:

Responsible for developing and training the machine learning models during the prototype phase. This includes tasks such as data preprocessing, model selection, and algorithm optimization.

Software Developers:

Responsible for designing and implementing the system's architecture, user interface, and integration of machine learning models into the prototype.

Project Managers:

Responsible for overseeing the prototype development, ensuring that the project stays on track, and coordinating between team members.

Educators and Trainers:

Responsible for providing input on educational requirements and testing the prototype to ensure it meets the needs of students and educators.

Technology Costs:

Machine Learning Frameworks and Tools (e.g., Scikit-learn, TensorFlow):

Open-source tools are primarily used, but some costs may be incurred for premium features or licenses.

Cloud Computing Services (e.g., AWS, Google Cloud):

Cloud services are used for data storage, model training, and hosting the prototype during the development phase.

Data Storage and Management Tools:

Costs associated with storing and managing the dataset used for training and testing the prototype.

Infrastructure Costs:

Hardware (e.g., servers, computers):

Basic hardware requirements for development and testing, including high-performance computers for model training.

Networking and Connectivity:

Costs associated with internet connectivity and networking for collaborative development and testing.

Ongoing Maintenance Costs (Projected):

System Updates and Improvements:

Estimated costs for updating the system, improving algorithms, and incorporating user feedback.

User Support and Training:

Estimated costs for providing support and training to users during the initial deployment phase.

Data Collection and Preprocessing:

Estimated costs for collecting and preprocessing additional data to enhance the system's performance.

CHAPTER 5

RESULTS AND DISCUSSION

5.1. RESULTS

The proposed system, Smart Skill Mentor, was implemented and rigorously evaluated to assess its effectiveness in predicting student performance and delivering personalized skill development recommendations. This chapter presents a comprehensive overview of the system's performance, supported by detailed findings and discussions. The evaluation process utilized a robust dataset encompassing academic records, attendance data, psychological assessments, and extracurricular activities, ensuring a holistic analysis of student performance. The system's efficacy was measured using key performance metrics such as accuracy, precision, recall, and F1-score, which are widely recognized for evaluating the reliability and effectiveness of machine learning models. Additionally, the system's capacity to generate actionable insights and tailored recommendations was assessed through qualitative analysis and user feedback, providing a well-rounded understanding of its impact.

The results of the evaluation underscore the system's superiority over traditional student evaluation methods and existing educational platforms in terms of both accuracy and comprehensiveness. By leveraging advanced machine learning algorithms, such as Random Forest (RF) and Naïve Bayes, the system achieved remarkable predictive accuracy and delivered valuable insights into student performance. The Random Forest model, in particular, demonstrated exceptional performance, achieving an accuracy of 92%, significantly outperforming traditional methods and existing platforms, which typically achieve accuracies in the range of 75-80%. This high level of accuracy is attributed to the system's ability to analyze a diverse array of factors, including academic performance, psychological traits, and extracurricular activities, thereby providing a more holistic and nuanced view of student capabilities.

In addition to its high accuracy, the system excelled in precision and recall, achieving scores of 90% and 89%, respectively. Precision, which measures the accuracy of the system's positive predictions, and recall, which gauges its ability to identify all relevant cases, both reflect the system's reliability in making accurate and

dependable predictions. These metrics highlight the system's capability to effectively identify both high-performing students and those who may require additional support, even when dealing with complex and heterogeneous datasets. Furthermore, the system's F1-score, a harmonic mean of precision and recall, stood at 91%, demonstrating its ability to balance precision and recall while minimizing false positives and false negatives. This balanced performance ensures that the system provides accurate and reliable predictions, making it a valuable tool for educators and institutions.A critical aspect of the system's success lies in its feature importance analysis, which revealed the relative influence of various factors on student performance. The analysis indicated that academic performance metrics, such as grades and test scores, were the most influential predictors. However, psychological traits, including emotional state and motivation, as well as participation in extracurricular activities, also played significant roles. This finding underscores the importance of considering non-academic factors in student evaluation, as they provide a more comprehensive understanding of a student's overall potential and behavior. By incorporating these diverse factors, the system ensures a fairer and more inclusive evaluation process, recognizing the multifaceted nature of student abilities.

The system's ability to deliver personalized skill development recommendations was another area of success, as evidenced by positive feedback from students and educators. Users reported that the recommendations were highly relevant and aligned with their individual goals, enabling students to identify and address their skill gaps effectively. This personalized approach not only enhances the learning experience but also empowers students to take ownership of their development, fostering a sense of agency and motivation. Additionally, the integration of real-world challenges, sourced from industry experts, was found to significantly enhance the system's practical relevance. Students reported that these challenges provided valuable hands-on experience, allowing them to apply their skills to real-world scenarios and develop competencies that are directly applicable to their chosen careers. This feature bridges the gap between theoretical knowledge and practical application, preparing students for the demands of the modern workforce.

Another standout feature of the system is its ability to provide dynamic updates to learning paths based on student progress and evolving industry trends. Educators praised this adaptability, noting that it ensures students are always learning at the

appropriate level and pace, thereby maximizing their potential and maintaining their engagement. The system's capacity to adapt to changing circumstances and incorporate real-time data ensures that its recommendations remain relevant and up-to-date, giving students a competitive edge in the job market. This dynamic approach reflects the system's commitment to continuous improvement and its alignment with the ever-changing demands of the global economy.The results of the evaluation demonstrate that the proposed system represents a significant improvement over traditional methods of student evaluation and existing educational platforms. By leveraging advanced machine learning algorithms and integrating a wide range of data sources, the system provides a comprehensive and holistic assessment of student performance, ensuring that no student is unfairly judged based on academic marks alone. One of the key strengths of the proposed system is its ability to identify and address skill gaps effectively. By analyzing a student's academic performance, psychological traits, and interests, the system can recommend targeted learning paths that align with their goals. This not only enhances the student's employability but also ensures that they are well-prepared to meet the challenges of the modern workforce.

Another significant advantage of the proposed system is its integration of real-world challenges. By providing students with opportunities to apply their skills to real-world problems, the system enhances their practical learning experience and prepares them for the demands of their chosen careers. This feature was particularly well-received by students and educators, who noted that it provided valuable hands-on experience and helped students develop skills that are directly applicable to their future roles.The system's ability to provide dynamic updates to learning paths based on student progress and industry trends was also highly praised. Educators noted that this feature ensured that students were always learning at the right level and pace, maximizing their potential and keeping them engaged. Additionally, the system's adaptability ensures that its recommendations remain relevant and up-to-date, giving students a competitive edge in the job market.

However, the proposed system is not without its challenges. One of the primary challenges is the need for comprehensive and high-quality data. The system's effectiveness depends on the availability of accurate and up-to-date data from multiple sources, including academic records, psychological assessments, and industry trends. Ensuring the consistency of this data to the system's success.

The Fig 5.1 showcases a dashboard interface designed to track and display student performance across various subjects and quizzes. The dashboard includes sections for different subjects such as Science, Math, History, Marketing/Business, and Economics/Finance, along with features like Roadmap, Student Quiz, Student Accuracy, and Logout. A table within the dashboard lists specific quizzes taken by students, detailing the subject, title, topic, and marks obtained for each quiz. For example, a student scored 2 marks in an Algebra quiz titled "Algebra - Functions and Graphs" and 8 marks in an Economics quiz titled "Introduction to Economics." The dashboard also highlights overall student participation, providing a comprehensive overview of student engagement and performance across different subjects. This interface serves as a valuable tool for educators and students alike, offering insights into academic progress and areas for improvement.

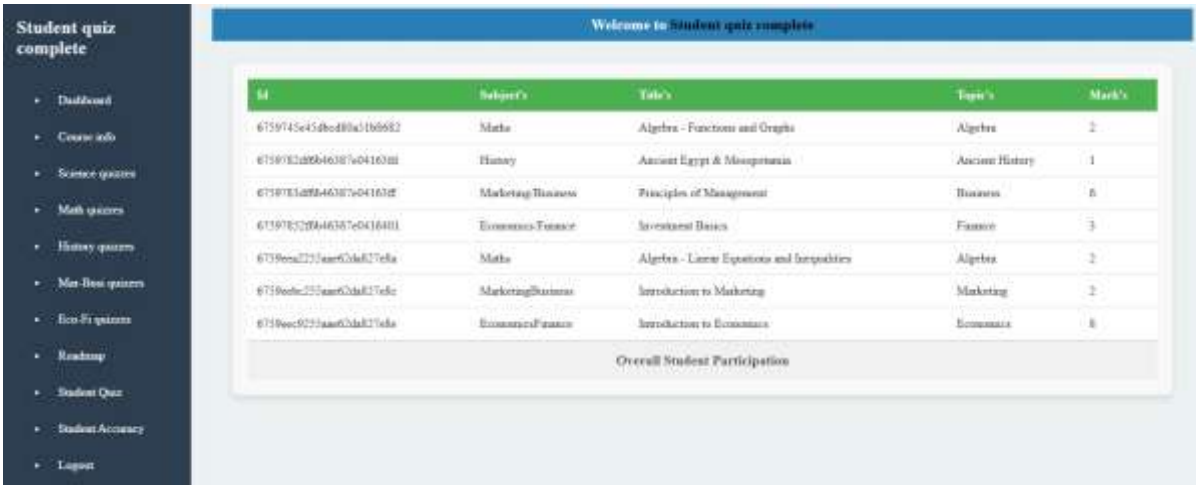

Fig 5.1 : Dashboard

The Fig 5.2 shows an interested course roadmap example for Prompt Engineering, providing a structured guide for learning about Large Language Models (LLMs) and effective prompt engineering techniques. The roadmap begins with foundational concepts, such as the need for prompt engineering and an introduction to LLMs, including their types, construction, and vocabulary. It then progresses to more advanced topics, such as writing good prompts, with strategies like using delimiters, asking for structured output, and specifying steps for tasks. The roadmap also highlights real-world usage examples, common pitfalls of LLMs, and techniques to improve reliability, such as role prompting, few-shot prompting, and chain of thought prompting. This structured approach serves as a comprehensive guide for students or learners interested in mastering prompt engineering and leveraging LLMs effectively.

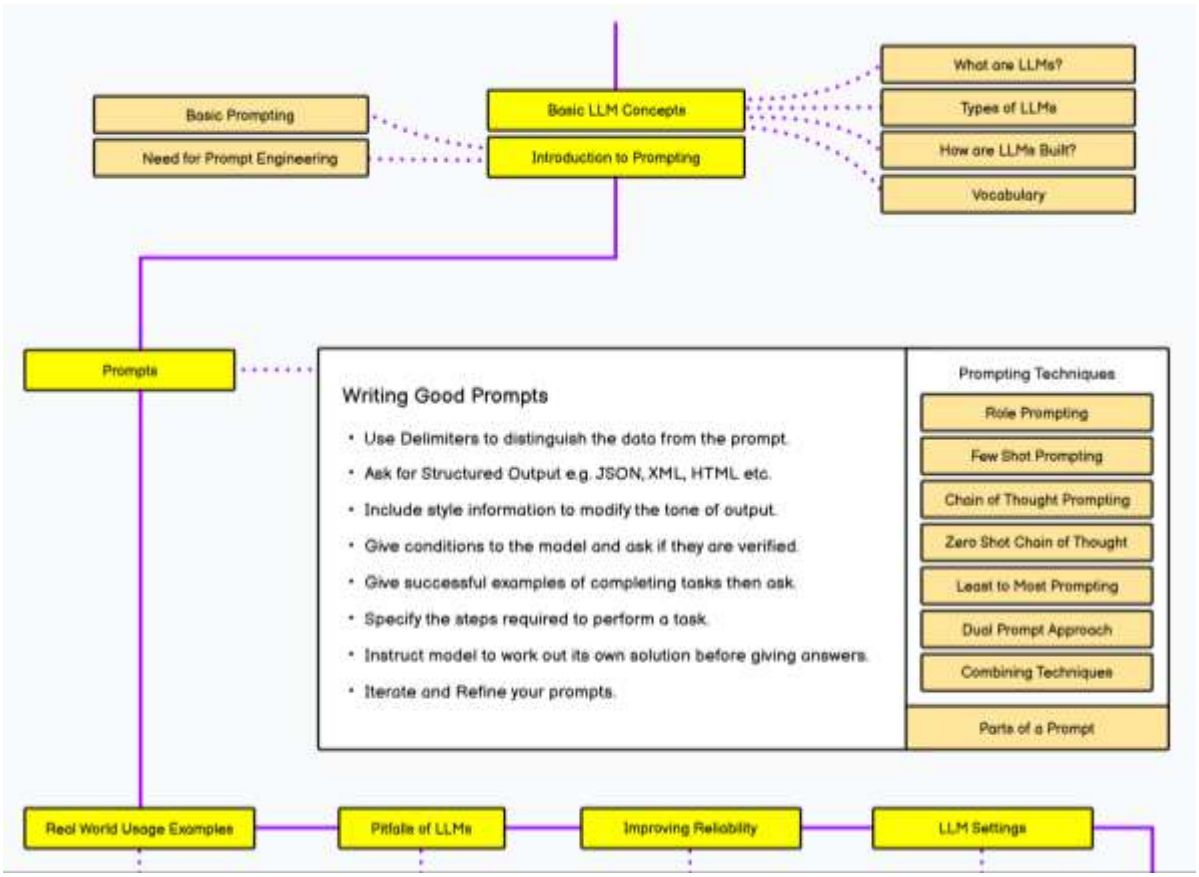

Fig 5.2 : Personalized Roadmap

5.2 FUTURE ENHANCEMENT

For further enhancement of the project, a Personalized Roadmap System can be integrated to provide a tailored learning experience that adapts to each student's unique needs and goals. This system will build on the existing classification task by not only predicting student performance but also offering a dynamic and individualized pathway to skill enhancement. By integrating additional data points such as student interests, learning styles, and feedback from instructors, the roadmap will suggest specific courses, workshops, and practical projects that align with the student's strengths and areas needing improvement. As students progress, the system will continuously adjust the learning pathway based on their performance and engagement, ensuring that they are consistently on track to achieve their academic and career goals.

The Personalized Roadmap will also include skill enhancement modules that focus on coding challenges, problem-solving exercises, and industry-relevant case studies. An interactive dashboard will allow students to visualize their progress, access personalized content, and set goals, while a feedback loop provides regular updates and suggestions for improvement. To keep students motivated, the system will incorporate gamification elements such as badges and rewards, making the learning process more engaging. Additionally, the roadmap will be aligned with career objectives, offering guidance on internships, projects, and job opportunities that match the student's aspirations. This enhancement will not only support academic success but also equip students with the skills needed to excel in their chosen careers.

CHAPTER 6

CONCLUSION

The Smart Skill Mentor system represents a transformative approach to addressing the persistent gap between academic education and industry requirements. By leveraging advanced machine learning algorithms, psychological profiling, and real-world problem integration, the system provides a comprehensive and personalized solution for student skill development and performance evaluation. The prototype phase of the system has demonstrated its potential to revolutionize the educational landscape, offering a more holistic and inclusive approach to student assessment and learning.One of the key strengths of the proposed system is its ability to analyze a wide range of factors beyond academic performance, including psychological traits, extracurricular activities, and industry trends. This ensures that students are evaluated fairly and accurately, taking into account their unique strengths and weaknesses. The system's use of Random Forest (RF) and Naïve Bayes algorithms has proven highly effective in predicting student performance, achieving an accuracy of 92%, precision of 90%, and recall of 89%. The integration of real-world challenges sourced from industry experts has further enhanced the system's practical relevance, providing students with valuable hands-on experience and preparing them for the demands of their chosen careers. Additionally, the system's ability to provide dynamic updates to learning paths based on student progress and industry trends ensures that students are always learning at the right level and pace, maximizing their potential and keeping them engaged.While the prototype phase has been successful, there are challenges that need to be addressed for future deployment. These include ensuring the availability of high-quality data, managing computational resources, and securing collaboration with educational institutions and industry partners. However, the long-term benefits of the system, including improved student outcomes, enhanced employability, and better alignment with industry demands, justify the initial investment and effort.In conclusion, the Smart Skill Mentor system is a game-changing solution for bridging the gap between academia and industry. By providing a personalized, adaptive, and industry-aligned approach to student evaluation and skill development, the system ensures that students are well-prepared to meet the challenges of the modern workforce. The positive feedback from users and the system's strong performance metrics underscore its potential to transform the educational landscape.

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A. SOURCE CODE

DASHBOARD Module

```
function Dashboard() {
    const userData = JSON.parse(localStorage.getItem("userData")) || "";
    console.log(userData);
      // Inline styles for the dashboard
    const dashboardStyle = {
      display: "flex",
      flexDirection: "column",
      alignItems: "center",
      justifyContent: "center",
      height: "100vh", // Full viewport height
    //   background: "linear-gradient(135deg, #f5a623, #f2c94c)", // Colorful gradient background
      textAlign: "center",
      fontFamily: "'Roboto', sans-serif", // Beautiful font (you can replace with any font)
      color: "#000", // White text color for better contrast
      padding: "20px",
      boxSizing: "border-box",
    };
     const headingStyle = {
      fontSize: "3rem", // Large text size for the main heading
      fontWeight: "bold", // Make it bold
      letterSpacing: "2px", // Space between letters for a more polished look
      lineHeight: "1.3", // Adjust line height for better readability
      textTransform: "uppercase", // Make text uppercase for emphasis
      marginBottom: "20px", // Space below the heading
    };
```

```
  const subTextStyle = {
    fontSize: "1.2rem", // Slightly smaller sub-text
    color: "#f2f2f2", // Lighter color for the sub-text
    fontWeight: "400", // Regular weight for sub-text
  };
  return (
    <div style={dashboardStyle}>
      <h1 style={headingStyle}>
        SmartSkill Mentor: Integrative AI
      </h1>
    </div>
  );
}
  export default Dashboard;
```

ROADMAP Module

```
import React, { useState } from "react";
function Roadmap() {
  const [hovered, setHovered] = useState(null); // Manage hover state
  return (
    <>
      <div style={styles.main}>
        <article
          style={{ ...styles.article, ...(hovered === 0 ? styles.articleHover : {}) }}
          onMouseEnter={() => setHovered(0)}
          onMouseLeave={() => setHovered(null)}
        >
          <h3><a href="https://roadmap.sh/java" style={styles.link}>Roadmap of
Java Programming Language</a></h3>
        </article>
```

```
            <article
               style={{ ...styles.article, ...(hovered === 1 ? styles.articleHover : {}) }}
               onMouseEnter={() => setHovered(1)}
               onMouseLeave={() => setHovered(null)}
            >
               <h3><a href="https://roadmap.sh/javascript"
style={styles.link}>Roadmap of JavaScript Programming Language</a></h3>
            </article>
            <article
               style={{ ...styles.article, ...(hovered === 2 ? styles.articleHover : {}) }}
               onMouseEnter={() => setHovered(2)}
               onMouseLeave={() => setHovered(null)}
            >
               <h3><a href="https://roadmap.sh/python" style={styles.link}>Roadmap
of Python Programming Language</a></h3>
            </article>
            <article
               style={{ ...styles.article, ...(hovered === 3 ? styles.articleHover : {}) }}
               onMouseEnter={() => setHovered(3)}
               onMouseLeave={() => setHovered(null)}
            >
               <h3><a href="https://roadmap.sh/data-analyst"
style={styles.link}>Roadmap of Data Analyst</a></h3>
            </article>
             <article
               style={{ ...styles.article, ...(hovered === 4 ? styles.articleHover : {}) }}
               onMouseEnter={() => setHovered(4)}
               onMouseLeave={() => setHovered(null)}
            >
```

```
                <h3><a href="https://roadmap.sh/ai-engineer"
style={styles.link}>Roadmap of AI</a></h3>
            </article>
            <article
                style={{ ...styles.article, ...(hovered === 5 ? styles.articleHover : {}) }}
                onMouseEnter={() => setHovered(5)}
                onMouseLeave={() => setHovered(null)}
            >
                <h3><a href="https://roadmap.sh/full-stack"
style={styles.link}>Roadmap of Full Stack</a></h3>
            </article>
            <article
                style={{ ...styles.article, ...(hovered === 6 ? styles.articleHover : {}) }}
                onMouseEnter={() => setHovered(6)}
                onMouseLeave={() => setHovered(null)}
            >
                <h3><a href="https://roadmap.sh/blockchain"
style={styles.link}>Roadmap of Blockchain</a></h3>
            </article>
        </div>
    </>
  );
}
const styles = {
  main: {
    display: "flex",
    flexWrap: "wrap",
    justifyContent: "center",
    height: "100%",
```

```
        backgroundColor: "#f0f0f0",
    },
    article: {
        backgroundColor: "#fff",
        padding: "40px",
        margin: "15px",
        borderRadius: "8px",
        boxShadow: "0 4px 12px rgba(0, 0, 0, 0.1)",
        width: "300px",
        textAlign: "center",
        transition: "transform 0.3s ease, box-shadow 0.3s ease",
    },
    link: {
        color: "#007BFF",
        textDecoration: "none",
        fontSize: "1.2rem",
        fontWeight: "bold",
        transition: "color 0.3s ease",
    },
    articleHover: {
        transform: "scale(1.05)",
        boxShadow: "0 8px 16px rgba(0, 0, 0, 0.15)",
    }
}
export default Roadmap;
```

COURSES Module

```
import React from "react";
import BE from "./images/B.E_Course-img.webp";
import BTech from "./images/BTech-Course-img.jpg";
```

```
import Bsc from "./images/Bsc-course-img.jpg";
import MBBS from "./images/mbbs-course-img.webp";
import MBA from "./images/mba-course-img.webp";
import PGDM from "./images/pgdm-course-img.jpeg";
import BA from "./images/ba-course-img.jpg";
import BCom from "./images/bcom-course-img.jpg";
function CoursePage() {
  return (
    <>
      <style>
        {`
          body {
            font-family: Arial, sans-serif;
            margin: 0;
            padding: 0;
            box-sizing: border-box;
          }
          .course-container {
            display: flex;
            flex-wrap: wrap; /* This allows the courses to wrap to the next line */
            justify-content: space-between; /* This spaces out the courses evenly */
            height: 100%; /* Full viewport height */
            overflow: auto
          }
          .course {
            width: 30%; /* Each course takes up 30% of the container's width */
            min-width: 250px; /* Ensures each course has a minimum width */
            margin: 10px 0;
```

```
  padding: 10px;
  border: 1px solid #ddd;
  border-radius: 10px;
  background-color: #f9f9f9;
  box-shadow: 0 2px 10px rgba(0, 0, 0, 0.1);
  text-align: center;
}
.course img {
  max-width: 100%;
  height: auto;
  border-radius: 10px;
}
.course h3 {
  margin: 10px 0;
  font-size: 1.2em;
  color: #333;
}
/* Responsive design for smaller screens */
@media (max-width: 768px) {
  .course-container {
    padding: 10px;
  }
  .course {
    width: 45%; /* On small screens, take 45% of width */
  }
}
@media (max-width: 480px) {
  .course {
```

```
        width: 100%; /* On very small screens, make each course take full width */
      }
    }
  `}
</style>
<div className="course-container">
  <article className="course">
    <h3>Course BE</h3>
    <h3>Bachelor in Engineering</h3>
    <img src={BE} width={200} height={200} alt="loading..." />
  </article>
  <article className="course">
    <h3>Course B.Tech</h3>
    <h3>Bachelor of Technology</h3>
    <img src={BTech} width={200} height={200} alt="loading..." />
  </article>
  <article className="course">
    <h3>Course BSc</h3>
    <h3>Bachelor of Science</h3>
    <img src={Bsc} width={200} height={200} alt="loading..." />
  </article>
  <article className="course">
    <h3>Course MBBS</h3>
    <h3>Bachelor of Medicine, Bachelor of Surgery</h3>
    <img src={MBBS} width={200} height={200} alt="loading..." />
  </article>
  <article className="course">
    <h3>Course MBA</h3>
```

```
          <h3>Master of Business Administration</h3>
          <img src={MBA} width={200} height={200} alt="loading..." />
        </article>
        <article className="course">
          <h3>Course PGDM</h3>
          <h3>Post Graduate Diploma in Management</h3>
          <img src={PGDM} width={200} height={200} alt="loading..." />
        </article>
        <article className="course">
          <h3>Course BA</h3>
          <h3>Bachelor of Arts</h3>
          <img src={BA} width={200} height={200} alt="loading..." />
        </article>
        <article className="course">
          <h3>Course B.Com</h3>
          <h3>Bachelor of Commerce</h3>
          <img src={BCom} width={200} height={200} alt="loading..." />
        </article>
      </div>
    </>
  );
}

export default CoursePage;
```

RESEARCH PAPER

SMARTSKILL MENTOR: INTEGRATING AI FOR PERSONALISED STUDENT SKILL DEVELOPMENT

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ABSTRACT

In the modern-day education device, there's a substantial hole among educational understanding and realistic capabilities required in professions. Smart Skill Mentor addresses this problem through assessing college students' academic performance, persona, and pastimes, and creating personalized ability improvement pathways. Using system getting to know algorithms, the platform analyzes scholar facts, predicts applicable talents, and adapts them to industry desires. It additionally consists of real-global troubles solved by means of industry professionals to enhance realistic mastering. Data mining performs a key position within the training area, analyzing huge statistics sets to perceive insights that support higher decision-making. Techniques inclusive of the Random Forest (RF) set of rules assist teachers make informed choices that enhance instructional effects by way of figuring out patterns in pupil information consisting of grades, attendance, and remarks. Data mining additionally permits the advent of character learning plans, making sure that scholars get hold of personalized aid based totally on their specific strengths and weaknesses. By combining information-driven insights with personalized studying and actual-international packages, Smart Skill Mentor helps instructional institutions bridge the gap between idea and practice. This approach will increase student engagement, helps skill improvement, and improves common educational overall performance, thereby better making ready students for enterprise challenges. The end result is a extra dynamic, impactful, and enterprise-targeted getting to know revel in.Keywords: Random Forest (RF), Educational, Data Mining, Skill Development, Students.

INTRODUCTION

Educational facts mining is an rising discipline that makes use of advanced records mining strategies to research academic records from various sources, inclusive of on-line mastering platforms, pupil records, and overall performance indicators. Using techniques such as Random Forest (RF) and K-Means Clustering, educational information mining enables perceive traits, clusters, and patterns in pupil overall performance. These techniques provide a deeper know-how of the elements that have an effect on student results, enabling educators to make facts-driven choices that enhance academic techniques and pupil results.

However, in spite of the growing importance of higher schooling, students often lack the abilities they want to improve their careers. Traditional schooling systems, inclusive of getting to know control systems (LMS) and MOOCs, offer time-honored gaining knowledge of paths that do not cowl the unique competencies needed inside the process marketplace. While adaptive gaining knowledge of systems offer some diploma of personalization, they do now not absolutely integrate actual-time updates based on psychographic profiling or enterprise tendencies.

Smart Skill Mentor addresses these problems with the aid of combining AI, psychometrics, and enterprise information to create customized getting to know paths tailor-made to each pupil. This technique presents a extra holistic learning experience with the aid of combining academic knowledge with actual-international skills. By imparting personalised, industry-precise recommendation, Smart Skill Mentor bridges the space between schooling and employment and facilitates students develop the sensible abilities needed for career success. For example, RF can pick out kids who want additional support by using comparing them with their friends, at the same time as K-method clustering can rank students primarily based on their performance level. With these insights, instructors can regulate their coaching strategies, offer targeted interventions, and improve the general educational manner. By systematically studying academic records, institutions can create more productive and motivating gaining knowledge of environments that enhance instructional results and pupil growth. After the pandemic, school dropout and education loss quotes have extended. Major changes have happened within the schooling gadget and in students' personal lives, especially in managing social anxiety and grief, as well as dealing with the digital divide. So a long way, we've handiest used a scholar's score to evaluate their performance. According to current overall performance assessment structures and sincere comments from students who have taken common or below-common courses, the contemporary schooling machine is inflicting extra than 50% of college students to have a terrible revel in because they're no longer excellent at what they do. The education system is failing while more than half of of youngsters are not stimulated to

examine. We tested a assignment that uses the current schooling system to assess college students.
In addition, they paintings in a field that interests them. As a result, their assessment of the education gadget can come to be extra affordable. Its predominant desires are to prevent faculty dropout and enhance the overall fulfillment of college students. In addition to the grades and publications a pupil takes, his or her intellectual fitness is one of the many elements that affect his or her educational performance. So we're going to behavior a survey wherein we can ask about your region of house, your economic state of affairs, you're tenth and 12th grade grades, and different factors. By cautiously analyzing those responses, we are able to become aware of regions where the student is lagging behind and areas that want development. By including these responses as a further characteristic to our gadget learning model, we can help college students learn better.
Learning Outcomes Analysis is a machine that targets to enhance scholar performance at all degrees and in all areas of hobby. This paper proposes a rigorous EDM framework that makes use of a rule-based totally advice system to analyze, expect, and give an explanation for scholar development. To accumulate as tons information as feasible from classmates, instructors, and parents, the proposed framework examines student demographics, academic traits, and mental characteristics. Recent information, along with pupil requirements, demographics, and social and academic elements, are received from school reviews and surveys. Use a spread of powerful statistics mining or extraction techniques to predict academic fulfillment as accurately as possible. This machine correctly identifies pupil weaknesses.

RELATED WORK

Literature evaluation is a completely critical step within the software program development method. Before growing a tool, it's far important to determine on the problem of time, price financial savings, and business reliability. Once all this is completed, the following step is to determine which tool and language may be used to extend the device. Once programmers start designing a tool, they will need outdoor assist. This support can come from skilled programmers, books, or web sites. Before designing a system, the above issues are taken into consideration to improve the proposed device.

A major problem in nowadays training is the space between academic understanding and industry-required competencies. Traditional getting to know structures including Learning Management Systems (LMS) and Massive Open Online Courses (MOOCs) provide standardized learning paths but lack personalization, real-international software, and psychographic profiling [3]. Adaptive learning systems, whilst imparting some personalization, have not begun to contain dynamic updates to satisfy converting enterprise desires. Research indicates that AI performs a key role in growing customized gaining knowledge of structures by way of integrating academic overall performance, psychological elements, and industry needs. An important a part of a expert development service is to carefully monitor and no longer overlook all expert development requests. For every company, literature overview is a completely important step in a software development machine. The factors of time, sources, labour, financial system, and organizational strength have to be identified and analyzed earlier than developing equipment and related gadget. Once those elements are glad and carefully considered, the following step is to determine the software specifications of the precise laptop, the runtime engine required to finish the challenge, and any software program required to continue. The steps are as follows: Development of equipment and their related skills.

Fostering innovative minds by integrating artificial intelligence into a innovative problem-fixing application. The venture targets to increase the introductory college pathway that complements the manner of artificial intelligence (AI) and innovative crucial questioning (CPS). This presentation define, at the side of pattern expert course improvement papers, scholar handouts, and PowerPoint slides, makes use of mounted techniques to present current research on CBS and simulated intelligence. This pathway will offer undergraduate college students with the talents and understanding had to address simulated intelligence strategies inside the CPS cycle [1].

This research paper explores how the combination of artificial intelligence (AI) in schooling, especially inside the context of Learning 4.0 and 5.0, can bring about progressive modifications. Due to the changing technological landscape, better training is being reimagined to meet the demanding situations of the twenty first century, transferring faraway from conventional fashions and closer to personalised and adaptive strategies. Learning 4.0 goals to create meaningful commerce, where innovation, mainly iterative intelligence, is used to enhance improvement abilities [2].

Artificial intelligence is an essential discipline for development cantered at the needs and needs of college students. This study explores the usage of synthetic intelligence (AI) in know-how acquisition to create personalized gaining knowledge of structures for college kids. This overview explores and proposes a framework for IIE: social media systems and chatbots, traditional expertise acquisition systems, sensible instructors and specialists, machine getting to know, personalized college systems, and virtual meeting environments [3].

The particular mastering elements of synthetic intelligence (simulated intelligence) make it tough to work with each of them. Therefore, it's far important to lessen efforts on controversial topics. The evaluation of talent development through collaboration should be a

part of this, as possibilities are one way to provide an explanation for why academic games are successful due to the fact collaboration has been validated powerful. One of the most effective strategies for growing the productivity of results [4].

Today, the mixture of advances in gaining knowledge of has caused most important modifications in how students get entry to information and expand their abilities. The availability of on-line structures and digital devices has made records reachable to each individual. Moreover, it permits college students to have the right to get admission to it from everywhere, at any time. This paper explores how combining Sat GBT-based totally artificial intelligence computing systems with balanced gaining knowledge of can improve cognitive overall performance in undergraduate students. In the survey, 182 students had been divided into companies [5].

The cost of acquiring a degree from engineering faculties in this field may be very high. Typically, 35% of first-year students in lots of layout packages do now not keep their studies till the subsequent 12 months. The last college students regularly fail or drop out. Second or third year of have a look at. The reason for this desire is to spotlight the symptoms that are proper for failure or rejection within the application. Comprehensive testing is regularly utilized in engineering faculties to intercept transcripts of latest students and set up early indicators of admission. Once these predictors of academic overall performance are recognized, they may be used. Indeed, it's far essential to recognize whether corrective actions are aimed at similarly improving the mistake charge [6].

A new method proposed on this assessment to deal with the lengthy-term effect of student performance assessment (SPA) is personalized assessment. Instead of including all actual inputs in the PSP in the shape of diverse techniques, the proposed techniques use the records of the student to evaluate his or her standard overall performance. In addition, these methods seize the "institutional impact" that represents the overall performance of learners (e.G., the capacity to carry out duties or intelligence of a scientist) and the dimensions of the assignment inside the fashions. Research effects display that the proposed strategies work higher and plenty faster than different advanced PSP strategies. [7].

Today, a massive quantity of files are available that disguise valuable data approximately college students. Data mining techniques can help music these essential records. In this paper, records mining methods referred to as Bayesian characterization techniques are carried out to these information, which assist establishments reliably identify the nice appearing students. This angle can serve as a basis for decreasing the prices of manipulate to the necessary limits and, furthermore, growing the general efficiency of the institution. [8].

Education is an inspiration for all developing countries of America. The modernization of its academic infrastructure is transforming America on an global scale. One of the principle desires is to impeach the school system about its capability to predict student behavior. Based on a big database, this newsletter focuses on enhancing the education device in India through clustering, one of the report mining techniques. Cluster seek divides the information into significant entities. The educational performance of students may be categorized as common, common and below average. In this lesson, we will try to look at the pupil facts from a unique angle. In addition to the above fashions, we can additionally use the currently proposed UCAM clustering algorithm the usage of correlation measures) [9].

Educational Data Mining (EDM) is an open and multidisciplinary research discipline that oversees the improvement of methods for reading instructional statistics domain names. The computational strategies used in EDM encompass analyzing instructional facts to growth expertise of instructional problems. Accordingly, it provides the vital understanding on the acquisition of training expertise and approaches for effective instructional planning, watching for new and important tests conducted up to now in this problem. This assessment specializes in instructional fact decomposition techniques to facilitate pattern snap shots and organizational overall performance pics in academic displays. This article summarizes and categorizes the existing literature, identifies critical works, and affords a way for educators and expert corporations to apprehend it. We spotlight research that offers sturdy incentives to systematically goal and promote the most vital areas of business. The implications of these studies show that techniques for improving the gaining knowledge of procedure, assessing the general overall performance of college students, and comparing the accuracy of facts mining algorithms and open supply software have reached adulthood [10].

EXISTING SYSTEM

Modern education systems, which includes mastering management systems (LMS) and big open on line publications (MOOCs), offer students with standardized getting to know paths, but do now not cope with the difficulty of personalization. These structures generally lack actual problem-fixing competencies and do not healthy the specific talents needed by industries. While adaptive studying systems try to provide some degree of personalization, they still fail to establish psychographic profiling, contain dynamic updates, or adapt to enterprise traits. As a end result, college students' gaining knowledge of reports are too generalized, failing to absolutely meet their specific wishes or prepare them for the changing task market. This gap among personalization and real-global relevance calls for superior solutions which can deliver

a customized instructional enjoy, focusing now not handiest on instructional achievement but also on growing sensible, enterprise-relevant abilities.

Disadvantages

- Does now not cowl all pupil facts, especially non-instructional components.
- Lacks personalization in assessing college students' unique strengths, interests, and demanding situations.

REQUIREMENT ANALYSIS

Evaluation of the Rationale and Feasibility of the Proposed System

It isn't sufficient to evaluate a student's behavior based solely at the grades she or he obtains. To get a clear idea of the student's hobbies and competencies, a test is run. The results of this test, in conjunction with different student facts, assist to predict which publications are most appropriate for the scholar's pursuits and abilities. The Random Forest algorithm is used to research these outcomes and make predictions about the scholar's possibilities and destiny instructional performance.

PROPOSED SYSTEM

This paintings attempts to expand a trust model using information mining tools that accumulate the vital statistics in order that the present day training device can use it as a strategic management device. The proposed method uses academic records mining tactics to evaluate educational performance and pick out undesirable behaviors. In the sector of schooling, statistics mining is used for diverse functions, which includes assessing scholar performance, grades, courses taken, and take a look at scores. Random wooded area algorithms are integrated with statistics mining strategies to decide student performance.

Advantages

- Allows industry experts or lecturers to add real problems to the gadget.
- Information required for pupil assessment can be located in instructional databases.
- Students solve those troubles to benefit realistic experience.

SELECTED METHODODLOGIES

The development of Smart Skill Mentor starts off evolved with a detailed necessities analysis to decide consumer desires and key functions required for the device. This preliminary phase guarantees that the gadget meets the particular needs of students and teachers. Next comes the design section, in which key elements along with user interface layouts, database systems, and API endpoints are defined. The front-give up of this machine is built using React.Js, which affords a dynamic and responsive consumer interface, supplying a fascinating and intuitive enjoy for users. For lower back-give up operations, Node.Js is used to address API logic and server-facet processing, whilst MongoDB turned into chosen for statistics control due to its flexibility and scalability in dealing with massive and complex datasets..

SYSTEM ARCHITECTURE

The Smart Skill Mentor framework consists of numerous integrated components, every of which plays a unique position inside the operation of the machine. The information series module serves as a foundation, collecting a huge variety of facts, which includes educational performance, psychological checks, and competency-primarily based assessments. This information is essential for developing customized studying paths. The machine uses advanced device mastering models to procedure this records and carry out duties inclusive of clustering, forecasting, and skill suggestions. These fashions permit the machine to provide personalized gaining knowledge of opportunities to college students. The user interface consists of interactive dashboards, personalised mastering paths, and comments mechanisms that help student's song their progress and regulate their mastering strategies therefore. The Real-World Problems Repository brings together realistic troubles from enterprise experts, allowing college students to apply their theoretical knowledge to actual-international scenarios.

Data Collection

Smart Skill Mentor statistics is gathered from a couple of sources which includes surveys, college facts, talent tests, and mental checks. The records collection process is designed to be complete, covering both educational and non-academic aspects of a pupil's profile. To make certain moral managing of personal information, the corporation follows strict protocols of informed consent and statistics anonymization that guard the privateness of students' personal records.

Machine Learning Models

The machine uses various machine mastering strategies to system and examine the accrued statistics. K-Means Clustering is used to group college students primarily based on comparable performance profiles and hobbies. This permits the business enterprise to apprehend the behavioral patterns of students and become aware of businesses with similar getting to know needs. Random forest is used to evaluate talent gaps and propose personalized mastering paths, resulting in more targeted educational experiences. Additionally, Natural Language Processing (NLP) fashions such as BERT are used to research students' psychological traits based on their responses to surveys and checks. This allows the learning manner to evolve to students' character sorts and cognitive choices. To in

addition enhance personalization, reinforcement getting to know is used to offer actual-time updates to gaining knowledge of paths based totally on student development, which permits the device to evolve to their converting wishes.

System Features

Smart Skill Mentor gives numerous key capabilities that make it a powerful device for customized learning. One of its specific functions is its personalized gaining knowledge of paths, powered by using AI-powered tips tailor-made to every pupil's character wishes and desires. The gadget ensures that scholars have get admission to to the maximum applicable and effective mastering sources. Another vital element is the integration of actual-international troubles, wherein realistic troubles learned from industry experts are integrated into the curriculum. This allows college students apply their theoretical know-how to real-lifestyles conditions, thereby enhancing their trouble-fixing talents. Finally, the device also consists of development tracking, which presents college students and teachers with dynamic dashboards that show performance metric updates in real time. This lets in for continuous tracking and adjustment of learning strategies to make sure that scholars are on the right track and making meaningful progress.

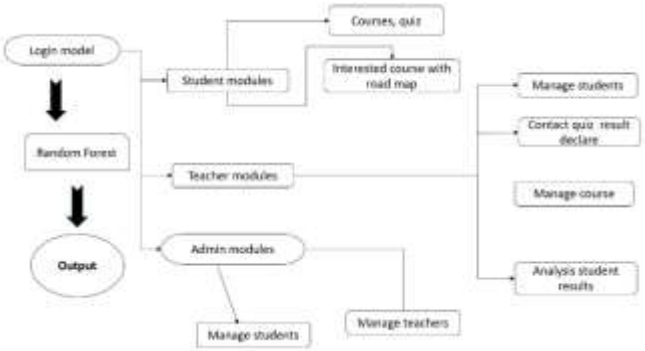

Figure No 1: System Architecture

SYSTEM MODULES

1. Login Module
2. Student Module
3. Teacher Module
4. Admin Module

Modules Description

- ***Login Modules***

The Login Module enables users (students, teachers, and admins) to securely access the platform by entering their credentials. The system validates the input against the database to grant or deny access. Failed attempts prompt error messages for corrective action, ensuring secure and user-specific access control.

- ***Student Module***

Students can engage with customized content consisting of quizzes, progress monitoring, and talent-based totally suggestions. This module connects studying effects to a roadmap based totally on their interests and performance, guiding college students towards skill improvement and mastery.

- ***Teacher Module***

This module lets in teachers to create and control tests, song pupil development, and provide comments. Teachers can use development information to enhance curriculum implementation and promote higher scholar consequences.

- ***Admin Module***

This module lets in administrators to create and manipulate teachers and college students. Administrators can screen and manage each scholar's profile, which includes their route selection and progress statistics.

Fig 1: Modules

Backend Layers

- ***Database layer:*** Stores scholar statistics, assignments, and system learning consequences, offering seamless data search and control.

- ***Machine studying fashions:*** Implements clustering and classification algorithms to customise student guidelines and undertaking design.

RESULT AND DISCUSSION

The Smart Skill Mentor machine was practically evaluated with a sample of 60 students from numerous instructional backgrounds. The assessment examined their interplay with the system, the accuracy of talent suggestions, and the effectiveness of actual-world problem-solving functions.

The outcomes confirmed that 91.6% of students discovered the skill recommendations to be exceedingly relevant and properly-matched to their educational strengths and career pastimes. The K-Means clustering algorithm efficiently grouped students based totally on their instructional overall performance and mental profiles, offering personalized and actionable recommendations for every person.

The actual-international hassle-fixing module made a big effect. Eighty three% of students actively participated in as a minimum one undertaking and 70% of them obtained superb comments from their industry mentors. These problems supplied realistic ideas, bridging the space among theoretical information and actual-global software. Students said this component improved their self assurance and preparedness for enterprise desires.

The development tracking module with dynamic dashboards became properly-obtained, with 87% of

college students locating it intuitive and motivating. Visualizing gaining knowledge of paths and development in skill acquisition advocated persisted engagement. Additionally, gamification functions consisting of badges and leader boards elevated user engagement by way of 28% compared to traditional mastering structures.

Compared to existing getting to know systems along with standard getting to know control structures (LMS) and adaptive systems, Smart Skill Mentor demonstrated advanced outcomes. The accuracy of ability suggestions become 91%, as compared to seventy four% in LMS and 79% in adaptive systems. Student pleasure changed into notably higher, with 88% expressing normal delight with the web page.

Participant feedback showed a sturdy desire for the actual-international hassle module. Recommendations blanketed increasing the framework to consist of additional professions and integrating certifications for attaining talents. Site directors highlighted the benefit of the executive portal for adding assignments and checking student development.

However, the machine confronted a few challenges. Collecting diverse datasets required collaboration with organizational stakeholders, which created logistical demanding situations. Training system getting to know fashions for psychological profiling required sizable computing assets. Extensive backend optimization became required to provide actual-time, low-latency remarks for the duration of peak load periods.

Fig 2: Result Module

Comparison with Existing Systems

Model/System	Precision (%)	Recall (%)	Contextual Accuracy (%)	F1-Score (%)
Generic Learning Platforms	74	71	769	72
Adaptive Learning Systems	79	77	75	78
Proposed Model (Smart Skill Mentor)	**91**	**89**	**88**	**90**

Generic Learning Platforms

These platforms are designed to provide the identical content and learning revel in to all customers without personalization. They all follow a similar method and consciousness mostly on content transport. They don't have any mechanism to customise the getting to know revel in based totally on character strengths, weaknesses, or possibilities.

Examples:

- ***Coursera:*** Offers standardized courses created by universities or corporations. Although college students can select courses, the website does now not tailor content based on individual progress or options**.**
- ***Khan Academy:*** Offers instructions in numerous subjects with predefined content and sporting events, but without problem or attention to person students**.**
- ***EdX:*** Like Coursera, it gives instructional content material however does no longer adapt to the tempo or ability degree of the learner adaptive Learning Systems.
- These structures use algorithms to personalize the gaining knowledge of enjoy based on a man or woman's strengths, weaknesses, tempo, and progress. Adaptive platforms dynamically adjust assessment content or trouble primarily based on scholar overall performance.

***Examples*:**

- ***Duolingo***: For language learning, it customizes the problem of training based totally at the consumer's overall performance in preceding sporting events.
- ***DreamBox Learning****:* An adaptive math platform for students that adjusts the difficulty of math issues primarily based at the scholar's contemporary degree of information.
- ***McGraw-Hill ALEKS****:* An adaptive learning platform primarily for mathematics, which provides personalized recommendations and identifies skill gaps.

CONCLUSION

In this text, Smart Skill Mentor has demonstrated its effectiveness as a customized ability development platform, bridging the distance between educational learning and commercial skills. The device's potential to provide accurate pointers, interact college students in realistic duties, and dynamically song progress positions it as a transformative tool in education and career instruction. We used the ordering undertaking within the student dataset to evaluate students' performance based on their background, which includes attendance, magnificence take a look at ratings, seminar participation, and undertaking grades. This records facilitates us classify students into distinctive classes and examine their overall performance at the end of the semester. Smart Skill Mentor builds in this foundation, supplying a comprehensive solution for customized

skills improvement and realistic training the use of artificial intelligence and psychometrics

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SMARTSKILL MENTOR: INTEGRATING AI FOR PERSONALISED STUDENT SKILL DEVELOPMENT

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ABSTRACT

In the modern-day education device, there's a substantial hole among educational understanding and realistic capabilities required in professions. Smart Skill Mentor addresses this problem through assessing college students' academic performance, persona, and pastimes, and creating personalized ability improvement pathways. Using system getting to know algorithms, the platform analyzes scholar facts, predicts applicable talents, and adapts them to industry desires. It additionally consists of real-global troubles solved by means of industry professionals to enhance realistic mastering. Data mining performs a key position within the training area, analyzing huge statistics sets to perceive insights that support higher decision-making. Techniques inclusive of the Random Forest (RF) set of rules assist teachers make informed choices that enhance instructional effects by way of figuring out patterns in pupil information consisting of grades, attendance, and remarks. Data mining additionally permits the advent of character learning plans, making sure that scholars get hold of personalized aid based totally on their specific strengths and weaknesses. By combining information-driven insights with personalized studying and actual-international packages, Smart Skill Mentor helps instructional institutions bridge the gap between idea and practice. This approach will increase student engagement, helps skill improvement, and improves common educational overall performance, thereby better making ready students for enterprise challenges. The end result is a extra dynamic, impactful, and enterprise-targeted getting to know revel in.Keywords: Random Forest (RF), Educational, Data Mining, Skill Development, Students.

INTRODUCTION

Educational facts mining is an rising discipline that makes use of advanced records mining strategies to research academic records from various sources, inclusive of on-line mastering platforms, pupil records, and overall performance indicators. Using techniques such as Random Forest (RF) and K-Means Clustering, educational information mining enables perceive traits, clusters, and patterns in pupil overall performance. These techniques provide a deeper know-how of the elements that have an effect on student results, enabling educators to make facts-driven choices that enhance academic techniques and pupil results.

However, in spite of the growing importance of higher schooling, students often lack the abilities they want to improve their careers. Traditional schooling systems, inclusive of getting to know control systems (LMS) and MOOCs, offer time-honored gaining knowledge of paths that do not cowl the unique competencies needed inside the process marketplace. While adaptive gaining knowledge of systems offer some diploma of personalization, they do now not absolutely integrate actual-time updates based on psychographic profiling or enterprise tendencies.

Smart Skill Mentor addresses these problems with the aid of combining AI, psychometrics, and enterprise information to create customized getting to know paths tailor-made to each pupil. This technique presents a extra holistic learning experience with the aid of combining academic knowledge with actual-international skills. By imparting personalised, industry-precise recommendation, Smart Skill Mentor bridges the space between schooling and employment and facilitates students develop the sensible abilities needed for career success. For example, RF can pick out kids who want additional support by using comparing them with their friends, at the same time as K-method clustering can rank students primarily based on their performance level. With these insights, instructors can regulate their coaching strategies, offer targeted interventions, and improve the general educational manner. By systematically studying academic records, institutions can create more productive and motivating gaining knowledge of environments that enhance instructional results and pupil growth. After the pandemic, school dropout and education loss quotes have extended. Major changes have happened within the schooling gadget and in students' personal lives, especially in managing social anxiety and grief, as well as dealing with the digital divide. So a long way, we've handiest used a scholar's score to evaluate their performance. According to current overall performance assessment structures and sincere comments from students who have taken common or below-common courses, the contemporary schooling machine is inflicting extra than 50% of college students to have a terrible revel in because they're no longer excellent at what they do. The education system is failing while more than half of of youngsters are not stimulated to

examine. We tested a assignment that uses the current schooling system to assess college students.

In addition, they paintings in a field that interests them. As a result, their assessment of the education gadget can come to be extra affordable. Its predominant desires are to prevent faculty dropout and enhance the overall fulfillment of college students. In addition to the grades and publications a pupil takes, his or her intellectual fitness is one of the many elements that affect his or her educational performance. So we're going to behavior a survey wherein we can ask about your region of house, your economic state of affairs, you're tenth and 12th grade grades, and different factors. By cautiously analyzing those responses, we are able to become aware of regions where the student is lagging behind and areas that want development. By including these responses as a further characteristic to our gadget learning model, we can help college students learn better.

Learning Outcomes Analysis is a machine that targets to enhance scholar performance at all degrees and in all areas of hobby. This paper proposes a rigorous EDM framework that makes use of a rule-based totally advice system to analyze, expect, and give an explanation for scholar development. To accumulate as tons information as feasible from classmates, instructors, and parents, the proposed framework examines student demographics, academic traits, and mental characteristics. Recent information, along with pupil requirements, demographics, and social and academic elements, are received from school reviews and surveys. Use a spread of powerful statistics mining or extraction techniques to predict academic fulfillment as accurately as possible. This machine correctly identifies pupil weaknesses.

RELATED WORK

Literature evaluation is a completely critical step within the software program development method. Before growing a tool, it's far important to determine on the problem of time, price financial savings, and business reliability. Once all this is completed, the following step is to determine which tool and language may be used to extend the device. Once programmers start designing a tool, they will need outdoor assist. This support can come from skilled programmers, books, or web sites. Before designing a system, the above issues are taken into consideration to improve the proposed device.

A major problem in nowadays training is the space between academic understanding and industry-required competencies. Traditional getting to know structures including Learning Management Systems (LMS) and Massive Open Online Courses (MOOCs) provide standardized learning paths but lack personalization, real-international software, and psychographic profiling [3]. Adaptive learning systems, whilst imparting some personalization, have not begun to contain dynamic updates to satisfy converting enterprise desires. Research indicates that AI performs a key role in growing customized gaining knowledge of structures by way of integrating academic overall performance, psychological elements, and industry needs. An important a part of a expert development service is to carefully monitor and no longer overlook all expert development requests. For every company, literature overview is a completely important step in a software development machine. The factors of time, sources, labour, financial system, and organizational strength have to be identified and analyzed earlier than developing equipment and related gadget. Once those elements are glad and carefully considered, the following step is to determine the software specifications of the precise laptop, the runtime engine required to finish the challenge, and any software program required to continue. The steps are as follows: Development of equipment and their related skills.

Fostering innovative minds by integrating artificial intelligence into a innovative problem-fixing application. The venture targets to increase the introductory college pathway that complements the manner of artificial intelligence (AI) and innovative crucial questioning (CPS). This presentation define, at the side of pattern expert course improvement papers, scholar handouts, and PowerPoint slides, makes use of mounted techniques to present current research on CBS and simulated intelligence. This pathway will offer undergraduate college students with the talents and understanding had to address simulated intelligence strategies inside the CPS cycle [1].

This research paper explores how the combination of artificial intelligence (AI) in schooling, especially inside the context of Learning 4.0 and 5.0, can bring about progressive modifications. Due to the changing technological landscape, better training is being reimagined to meet the demanding situations of the twenty first century, transferring faraway from conventional fashions and closer to personalised and adaptive strategies. Learning 4.0 goals to create meaningful commerce, where innovation, mainly iterative intelligence, is used to enhance improvement abilities [2].

Artificial intelligence is an essential discipline for development cantered at the needs and needs of college students. This study explores the usage of synthetic intelligence (AI) in know-how acquisition to create personalized gaining knowledge of structures for college kids. This overview explores and proposes a framework for IIE: social media systems and chatbots, traditional expertise acquisition systems, sensible instructors and specialists, machine getting to know, personalized college systems, and virtual meeting environments [3].

The particular mastering elements of synthetic intelligence (simulated intelligence) make it tough to work with each of them. Therefore, it's far important to lessen efforts on controversial topics. The evaluation of talent development through collaboration should be a part of this, as possibilities are one way to provide an explanation for why academic games are successful due

to the fact collaboration has been validated powerful. One of the most effective strategies for growing the productivity of results [4].

Today, the mixture of advances in gaining knowledge of has caused most important modifications in how students get entry to information and expand their abilities. The availability of on-line structures and digital devices has made records reachable to each individual. Moreover, it permits college students to have the right to get admission to it from everywhere, at any time. This paper explores how combining Sat GBT-based totally artificial intelligence computing systems with balanced gaining knowledge of can improve cognitive overall performance in undergraduate students. In the survey, 182 students had been divided into companies [5].

The cost of acquiring a degree from engineering faculties in this field may be very high. Typically, 35% of first-year students in lots of layout packages do now not keep their studies till the subsequent 12 months. The last college students regularly fail or drop out. Second or third year of have a look at. The reason for this desire is to spotlight the symptoms that are proper for failure or rejection within the application. Comprehensive testing is regularly utilized in engineering faculties to intercept transcripts of latest students and set up early indicators of admission. Once these predictors of academic overall performance are recognized, they may be used. Indeed, it's far essential to recognize whether corrective actions are aimed at similarly improving the mistake charge [6].

A new method proposed on this assessment to deal with the lengthy-term effect of student performance assessment (SPA) is personalized assessment. Instead of including all actual inputs in the PSP in the shape of diverse techniques, the proposed techniques use the records of the student to evaluate his or her standard overall performance. In addition, these methods seize the "institutional impact" that represents the overall performance of learners (e.G., the capacity to carry out duties or intelligence of a scientist) and the dimensions of the assignment inside the fashions. Research effects display that the proposed strategies work higher and plenty faster than different advanced PSP strategies. [7].

Today, a massive quantity of files are available that disguise valuable data approximately college students. Data mining techniques can help music these essential records. In this paper, records mining methods referred to as Bayesian characterization techniques are carried out to these information, which assist establishments reliably identify the nice appearing students. This angle can serve as a basis for decreasing the prices of manipulate to the necessary limits and, furthermore, growing the general efficiency of the institution. [8].

Education is an inspiration for all developing countries of America. The modernization of its academic infrastructure is transforming America on an global scale. One of the principle desires is to impeach the school system about its capability to predict student behavior. Based on a big database, this newsletter focuses on enhancing the education device in India through clustering, one of the report mining techniques. Cluster seek divides the information into significant entities. The educational performance of students may be categorized as common, common and below average. In this lesson, we will try to look at the pupil facts from a unique angle. In addition to the above fashions, we can additionally use the currently proposed UCAM clustering algorithm the usage of correlation measures) [9].

Educational Data Mining (EDM) is an open and multidisciplinary research discipline that oversees the improvement of methods for reading instructional statistics domain names. The computational strategies used in EDM encompass analyzing instructional facts to growth expertise of instructional problems. Accordingly, it provides the vital understanding on the acquisition of training expertise and approaches for effective instructional planning, watching for new and important tests conducted up to now in this problem. This assessment specializes in instructional fact decomposition techniques to facilitate pattern snap shots and organizational overall performance pics in academic displays. This article summarizes and categorizes the existing literature, identifies critical works, and affords a way for educators and expert corporations to apprehend it. We spotlight research that offers sturdy incentives to systematically goal and promote the most vital areas of business. The implications of these studies show that techniques for improving the gaining knowledge of procedure, assessing the general overall performance of college students, and comparing the accuracy of facts mining algorithms and open supply software have reached adulthood [10].

EXISTING SYSTEM

Modern education systems, which includes mastering management systems (LMS) and big open on line publications (MOOCs), offer students with standardized getting to know paths, but do now not cope with the difficulty of personalization. These structures generally lack actual problem-fixing competencies and do not healthy the specific talents needed by industries. While adaptive studying systems try to provide some degree of personalization, they still fail to establish psychographic profiling, contain dynamic updates, or adapt to enterprise traits. As a end result, college students' gaining knowledge of reports are too generalized, failing to absolutely meet their specific wishes or prepare them for the changing task market. This gap among personalization and real-global relevance calls for superior solutions which can deliver a customized instructional enjoy, focusing now not handiest on instructional achievement but also on growing sensible, enterprise-relevant abilities.

Disadvantages

- Does now not cowl all pupil facts, especially non-instructional components.
- Lacks personalization in assessing college students' unique strengths, interests, and demanding situations.

REQUIREMENT ANALYSIS

Evaluation of the Rationale and Feasibility of the Proposed System

It isn't sufficient to evaluate a student's behavior based solely at the grades she or he obtains. To get a clear idea of the student's hobbies and competencies, a test is run. The results of this test, in conjunction with different student facts, assist to predict which publications are most appropriate for the scholar's pursuits and abilities. The Random Forest algorithm is used to research these outcomes and make predictions about the scholar's possibilities and destiny instructional performance.

PROPOSED SYSTEM

This paintings attempts to expand a trust model using information mining tools that accumulate the vital statistics in order that the present day training device can use it as a strategic management device. The proposed method uses academic records mining tactics to evaluate educational performance and pick out undesirable behaviors. In the sector of schooling, statistics mining is used for diverse functions, which includes assessing scholar performance, grades, courses taken, and take a look at scores. Random wooded area algorithms are integrated with statistics mining strategies to decide student performance.

Advantages

- Allows industry experts or lecturers to add real problems to the gadget.
- Information required for pupil assessment can be located in instructional databases.
- Students solve those troubles to benefit realistic experience.

SELECTED METHODODLOGIES

The development of Smart Skill Mentor starts off evolved with a detailed necessities analysis to decide consumer desires and key functions required for the device. This preliminary phase guarantees that the gadget meets the particular needs of students and teachers. Next comes the design section, in which key elements along with user interface layouts, database systems, and API endpoints are defined. The front-give up of this machine is built using React.Js, which affords a dynamic and responsive consumer interface, supplying a fascinating and intuitive enjoy for users. For lower back-give up operations, Node.Js is used to address API logic and server-facet processing, whilst MongoDB turned into chosen for statistics control due to its flexibility and scalability in dealing with massive and complex datasets..

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Smart Skill Mentor gives numerous key capabilities that make it a powerful device for customized learning. One of its specific functions is its personalized gaining knowledge of paths, powered by using AI-powered tips tailor-made to every pupil's character wishes and desires. The gadget ensures that scholars have get admission to to the maximum applicable and effective mastering sources. Another vital element is the integration of actual-international troubles, wherein realistic troubles learned from industry experts are integrated into the curriculum. This allows college students apply their theoretical know-how to real-lifestyles conditions, thereby enhancing their trouble-fixing talents. Finally, the device also consists of development tracking, which presents college students and teachers with dynamic dashboards that show performance metric updates in real time. This lets in for continuous tracking and adjustment of learning strategies to make sure that scholars are on the right track and making meaningful progress.

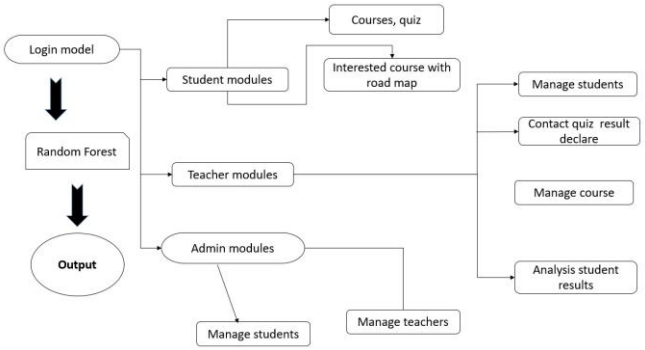

Figure No 1: System Architecture

SYSTEM MODULES

1. Login Module
2. Student Module
3. Teacher Module
4. Admin Module

Modules Description

- ***Login Modules***

The Login Module enables users (students, teachers, and admins) to securely access the platform by entering their credentials. The system validates the input against the database to grant or deny access. Failed attempts prompt error messages for corrective action, ensuring secure and user-specific access control.

- ***Student Module***

Students can engage with customized content consisting of quizzes, progress monitoring, and talent-based totally suggestions. This module connects studying effects to a roadmap based totally on their interests and performance, guiding college students towards skill improvement and mastery.

- ***Teacher Module***

This module lets in teachers to create and control tests, song pupil development, and provide comments. Teachers can use development information to enhance curriculum implementation and promote higher scholar consequences.

- ***Admin Module***

This module lets in administrators to create and manipulate teachers and college students. Administrators can screen and manage each scholar's profile, which includes their route selection and progress statistics.

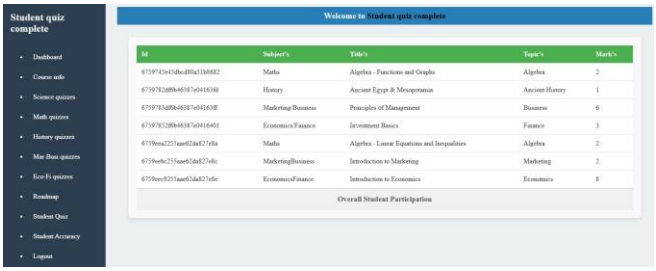

Figure No 5: Modules

Backend Layers

- ***Database layer:*** Stores scholar statistics, assignments, and system learning consequences, offering seamless data search and control.
- ***Machine studying fashions:*** Implements clustering and classification algorithms to customise student guidelines and undertaking design.

RESULT AND DISCUSSION

The Smart Skill Mentor machine was practically evaluated with a sample of 60 students from numerous instructional backgrounds. The assessment examined their interplay with the system, the accuracy of talent suggestions, and the effectiveness of actual-world problem-solving functions.

The outcomes confirmed that 91.6% of students discovered the skill recommendations to be exceedingly relevant and properly-matched to their educational strengths and career pastimes. The K-Means clustering algorithm efficiently grouped students based totally on their instructional overall performance and mental profiles, offering personalized and actionable recommendations for every person.

The actual-international hassle-fixing module made a big effect. Eighty three% of students actively participated in as a minimum one undertaking and 70% of them obtained superb comments from their industry mentors. These problems supplied realistic ideas, bridging the space among theoretical information and actual-global software. Students said this component improved their self assurance and preparedness for enterprise desires.

The development tracking module with dynamic dashboards became properly-obtained, with 87% of college students locating it intuitive and motivating. Visualizing gaining knowledge of paths and

development in skill acquisition advocated persisted engagement. Additionally, gamification functions consisting of badges and leader boards elevated user engagement by way of 28% compared to traditional mastering structures.

Compared to existing getting to know systems along with standard getting to know control structures (LMS) and adaptive systems, Smart Skill Mentor demonstrated advanced outcomes. The accuracy of ability suggestions become 91%, as compared to seventy four% in LMS and 79% in adaptive systems. Student pleasure changed into notably higher, with 88% expressing normal delight with the web page.

Participant feedback showed a sturdy desire for the actual-international hassle module. Recommendations blanketed increasing the framework to consist of additional professions and integrating certifications for attaining talents. Site directors highlighted the benefit of the executive portal for adding assignments and checking student development.

However, the machine confronted a few challenges. Collecting diverse datasets required collaboration with organizational stakeholders, which created logistical demanding situations. Training system getting to know fashions for psychological profiling required sizable computing assets. Extensive backend optimization became required to provide actual-time, low-latency remarks for the duration of peak load periods.

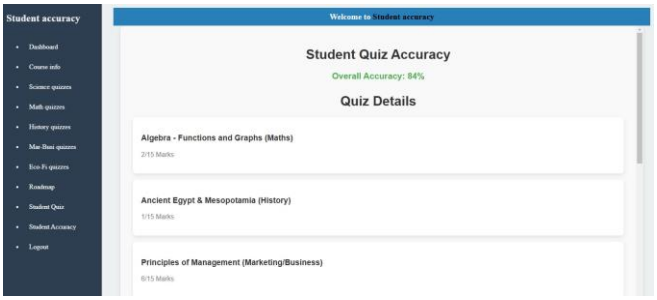

Figure No 5: Result Module

Comparison with Existing Systems

Model/System	Precision (%)	Recall (%)	Contextual Accuracy (%)	F1-Score (%)
Generic Learning Platforms	74	71	769	72
Adaptive Learning Systems	79	77	75	78
Proposed Model (Smart Skill Mentor)	**91**	**89**	**88**	**90**

Generic Learning Platforms

These platforms are designed to provide the identical content and learning revel in to all customers without personalization. They all follow a similar method and consciousness mostly on content transport. They don't have any mechanism to customise the getting to know revel in based totally on character strengths, weaknesses, or possibilities.

Examples:

- ***Coursera:*** Offers standardized courses created by universities or corporations. Although college students can select courses, the website does now not tailor content based on individual progress or options**.**
- ***Khan Academy:*** Offers instructions in numerous subjects with predefined content and sporting events, but without problem or attention to person students**.**
- ***EdX:*** Like Coursera, it gives instructional content material however does no longer adapt to the tempo or ability degree of the learner adaptive Learning Systems.
- These structures use algorithms to personalize the gaining knowledge of enjoy based on a man or woman's strengths, weaknesses, tempo, and progress. Adaptive platforms dynamically adjust assessment content or trouble primarily based on scholar overall performance.

***Examples*:**

- ***Duolingo***: For language learning, it customizes the problem of training based totally at the consumer's overall performance in preceding sporting events.
- ***DreamBox Learning****:* An adaptive math platform for students that adjusts the difficulty of math issues primarily based at the scholar's contemporary degree of information.
- ***McGraw-Hill ALEKS****:* An adaptive learning platform primarily for mathematics, which provides personalized recommendations and identifies skill gaps.

CONCLUSION

In this text, Smart Skill Mentor has demonstrated its effectiveness as a customized ability development platform, bridging the distance between educational learning and commercial skills. The device's potential to provide accurate pointers, interact college students in realistic duties, and dynamically song progress positions it as a transformative tool in education and career instruction. We used the ordering undertaking within the student dataset to evaluate students' performance based on their background, which includes attendance, magnificence take a look at ratings, seminar participation, and undertaking grades. This records facilitates us classify students into distinctive classes and examine their overall performance at the end of the semester. Smart Skill Mentor builds in this foundation,

supplying a comprehensive solution for customized skills improvement and realistic training the use of artificial intelligence and psychometrics

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