STUDENT RESULTS TRACKER AND PREDICTION

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Abstract

The Students Results Tracker and Prediction system is designed to efficiently manage, analyze, and predict students' academic performance using historical academic data. Educational institutions generate a large amount of student information related to marks, attendance, assignments, internal assessments, examinations, subjects, and overall performance. Managing and analyzing this information manually can be time-consuming and may make it difficult to identify students who require additional academic support. The proposed system provides a centralized platform for recording student results, tracking academic progress, analyzing subject-wise performance, and predicting future results. The collected student data is first preprocessed by handling missing values, duplicate records, inconsistent information, and categorical attributes. Exploratory Data Analysis is performed to identify relationships between attendance, previous marks, study patterns, subject performance, and overall results. Data visualization techniques are used to display student performance through charts, graphs, and dashboards. Machine-learning algorithms such as Linear Regression, Decision Tree, Random Forest, and Gradient Boosting can be applied to predict students' expected marks or performance levels based on historical academic information. The trained models are evaluated using suitable metrics such as MAE, MSE, RMSE, and R^2 score for marks prediction, or accuracy, precision, recall, and F1-score for performance classification. The system can identify students who may be at academic risk and provide useful insights to teachers and administrators. It also helps students understand their academic progress and areas that may require improvement. Overall, the Students Results Tracker and Prediction system combines result management, data analysis, visualization, and machine learning to support academic monitoring, performance prediction, and data-driven educational decision-making.

I. Introduction

The education sector generates a large amount of student academic data through examinations, assignments, attendance, internal assessments, practicals, and other academic activities. Managing and analyzing this information effectively is important for understanding students' academic progress and identifying areas that require improvement. Traditional methods of maintaining student results often involve spreadsheets, paper records, or basic software systems, which can make it difficult to track performance over multiple examinations and subjects. Therefore, an automated system that can track, analyze, and predict student performance can provide useful support to students, teachers, and educational institutions.

The Students Results Tracker and Prediction system is developed to provide a centralized platform for managing student academic records and analyzing their performance. The system can maintain information such as student details, subject-

wise marks, attendance percentage, internal assessment scores, assignment marks, examination results, total marks, percentage, and grades. By storing these details in a structured format, the system makes it easier to monitor individual and overall academic performance. It also reduces the manual effort required to calculate and maintain student results.

The system begins with the collection of historical student academic data from examination records or suitable datasets. The collected data may contain missing values, duplicate records, inconsistent information, and categorical attributes such as grades or performance levels. Data preprocessing techniques are applied to clean and transform the dataset into a suitable format for analysis. Missing values and duplicate records are handled appropriately, while categorical variables can be encoded when required. This preprocessing stage helps improve the quality and reliability of the data used for analysis and prediction.

The system can provide a user-friendly dashboard for tracking and analyzing student results. The dashboard may display total students, average marks, subject-wise performance, pass percentage, grade distribution, attendance information, and predicted results. Students can view their individual performance and identify subjects in which they need improvement. Teachers and administrators can analyze the performance of individual students as well as entire classes.

The prediction results can help identify students who may require additional academic support before final examinations. Teachers can use these insights to provide personalized guidance, additional learning materials, or remedial classes. Students can also use the predicted results to understand their current academic position and focus on areas where improvement is needed. The predictions should be treated as academic decision-support information rather than a guaranteed final result, since actual performance can be affected by many factors.

II. Literature Survey

The use of Educational Data Mining (EDM) and machine learning has become increasingly important for analyzing and predicting student academic performance. Educational institutions generate large amounts of data through examinations, attendance, assignments, internal assessments, learning-management systems, and student information systems. Researchers have explored this data to identify patterns that influence academic success and to predict student performance before final examinations. These approaches can help teachers identify students who may need additional academic support and enable institutions to make more informed educational decisions.

Zhang et al. presented a systematic review of Student Performance Prediction (SPP) using machine learning and data-mining techniques. Their study described student performance prediction as a process involving data collection, problem formulation, model development, prediction, and application. The researchers also experimented with educational datasets and discussed challenges related to data collection, prediction models, and practical applications. Their work shows that performance prediction can contribute to personalized education and early academic intervention.

Batool et al. conducted a comprehensive survey of approximately 260 studies on educational data mining and student academic performance prediction. Their research examined important factors, prediction algorithms, feature-selection methods, and commonly used tools. The study reported that Artificial Neural Networks and Random Forest were among the frequently used algorithms, while academic records and demographic characteristics were important predictive attributes. The researchers also emphasized that irrelevant features can reduce prediction performance, making feature selection an important part of the prediction process.

Roslan and Chen performed a systematic literature review of student performance prediction research published between 2015 and 2021. Their review analyzed 58 selected studies and found that researchers commonly focused on identifying factors influencing student performance, evaluating data-mining algorithms, and using data from e-learning environments. The study found that classification was the most frequently used data-mining approach and that Decision Tree was one of the most commonly employed algorithms. Academic records and demographic information were identified as important factors in predicting student performance.

Chaka reviewed research on educational data mining, student academic performance prediction, prediction methods, algorithms, and tools. The study synthesized findings from review papers published between 2013 and 2021 and examined the methods used for predicting academic performance in higher education. The research demonstrates that educational data mining can support institutions in extracting meaningful information from large educational datasets. It also highlights the importance of selecting appropriate prediction techniques according to the available data and prediction objective.

A systematic review by Xiao et al. examined 80 important studies on predicting student performance using educational data-mining methods between 2016 and 2021. The researchers analyzed the complete process of developing student-performance prediction models and discussed data collection, preprocessing, modeling, and interpretation. The study emphasized that educational institutions generate substantial data through student information systems, learning-management systems, MOOCs, and virtual learning environments. It also identified challenges related to data quality, prediction methods, and interpretation of machine-learning results.

Recent research continues to expand the use of machine learning, deep learning, and Explainable AI (XAI) for student performance prediction. A 2026 comprehensive review analyzed 72 studies and found that tree-based models and neural networks are dominant approaches, while explainable AI is becoming increasingly important for making predictions understandable and useful for educational decision-making. The review also emphasized the importance of early prediction because identifying students at risk can allow educators to provide timely interventions.

III. System Analysis

The **Students Results Tracker and Prediction** system is designed to manage, analyze, and predict students' academic performance efficiently. The system maintains important student information such as subject marks, attendance, internal assessment scores, assignment marks, examination results, grades, and overall

percentage. Historical academic records are used to identify patterns and factors that influence student performance. The system first collects and organizes student result data for further processing and analysis. Data preprocessing is performed to handle missing values, duplicate records, inconsistent information, and categorical attributes. Exploratory Data Analysis is conducted to understand subject-wise performance, grade distributions, and relationships between different academic factors. Data visualization techniques are used to represent student performance through charts, graphs, and dashboards. Relevant academic features are selected and transformed into a suitable format for machine-learning algorithms. Different machine-learning models can be trained using historical student data to predict future academic performance. The trained model can estimate expected marks, percentage, grades, or performance categories for students. Model performance can be evaluated using suitable metrics such as MAE, MSE, RMSE, R^2, accuracy, precision, recall, and F1-score depending on the prediction task. Overall, the system converts student academic records into meaningful insights and predictions that can support students, teachers, and educational institutions in improving academic performance.

Existing System

In the existing system, student academic records are generally maintained using paper records, spreadsheets, or basic educational management software. Student marks, attendance, assignments, internal assessments, and examination results are recorded separately by teachers or administrative staff. Traditional systems mainly focus on storing and displaying examination results rather than analyzing long-term academic performance. Teachers may manually calculate total marks, percentages, grades, and other performance indicators for individual students. When the number of students increases, maintaining and analyzing large amounts of academic data becomes difficult and time-consuming. Historical student information may be available, but it is not always effectively used for predicting future performance. Identifying students who are likely to perform poorly may depend mainly on teacher observation and previous examination results. Traditional systems generally provide limited visualization and predictive analytics capabilities. It can also be difficult to identify relationships between attendance, assignments, previous marks, and final results. Generating detailed student-performance reports may require additional manual work. The absence of machine-learning-based prediction limits the ability to provide early academic support. Therefore, an improved system is required to combine result tracking, performance analysis, visualization, and prediction in a single platform.

Disadvantages of Existing System

- Manual result management can be time-consuming.
- Large numbers of student records are difficult to manage efficiently.
- Greater possibility of calculation and data-entry errors.
- Limited analysis of historical academic performance.
- Limited ability to predict future student performance.
- Difficult to identify academically at-risk students early.
- Limited visualization of student performance.
- Historical academic data may not be fully utilized.
- Difficult to analyze multiple performance factors simultaneously.
- Generating detailed reports may require additional manual effort.

- Limited support for personalized academic guidance.
- Heavy dependence on manual observation and traditional reporting.

Proposed System

The proposed **Students Results Tracker and Prediction** system provides an integrated platform for managing, analyzing, and predicting student academic performance. The system stores student information including subject marks, attendance, assignments, internal assessments, examination results, grades, and overall performance. Historical academic data is analyzed to identify important factors and patterns associated with student success or poor performance. The collected data is first preprocessed by handling missing values, duplicate records, inconsistent information, and categorical attributes. Exploratory Data Analysis is performed to understand subject-wise performance, grade distribution, attendance patterns, and relationships between academic variables. Visualization techniques are used to display student progress and performance trends through charts, graphs, and dashboards. Relevant features are selected and transformed into a suitable format for machine-learning models. Algorithms such as Linear Regression, Decision Tree, Random Forest, and Gradient Boosting can be applied depending on whether the project predicts marks or performance categories. The trained models learn relationships between historical academic factors and student results. The models are evaluated using suitable performance metrics to identify an effective prediction model. The selected model can then predict expected marks, percentage, grades, or performance levels for new or existing students. Overall, the proposed system helps students and teachers monitor academic progress, identify students requiring additional support, and make data-driven educational decisions.

Advantages of Proposed System

- Automates student result management.
- Reduces manual effort in maintaining academic records.
- Minimizes calculation and data-entry errors.
- Efficiently manages large amounts of student data.
- Provides prediction of future academic performance.
- Helps identify students who may be academically at risk.
- Provides subject-wise and overall performance analysis.
- Displays performance through charts, graphs, and dashboards.
- Helps identify factors influencing student performance.
- Supports early academic intervention.
- Allows comparison of different machine-learning models.
- Provides measurable model performance using evaluation metrics.
- Supports data-driven decision-making for teachers and administrators.
- Can be extended with personalized learning recommendations.

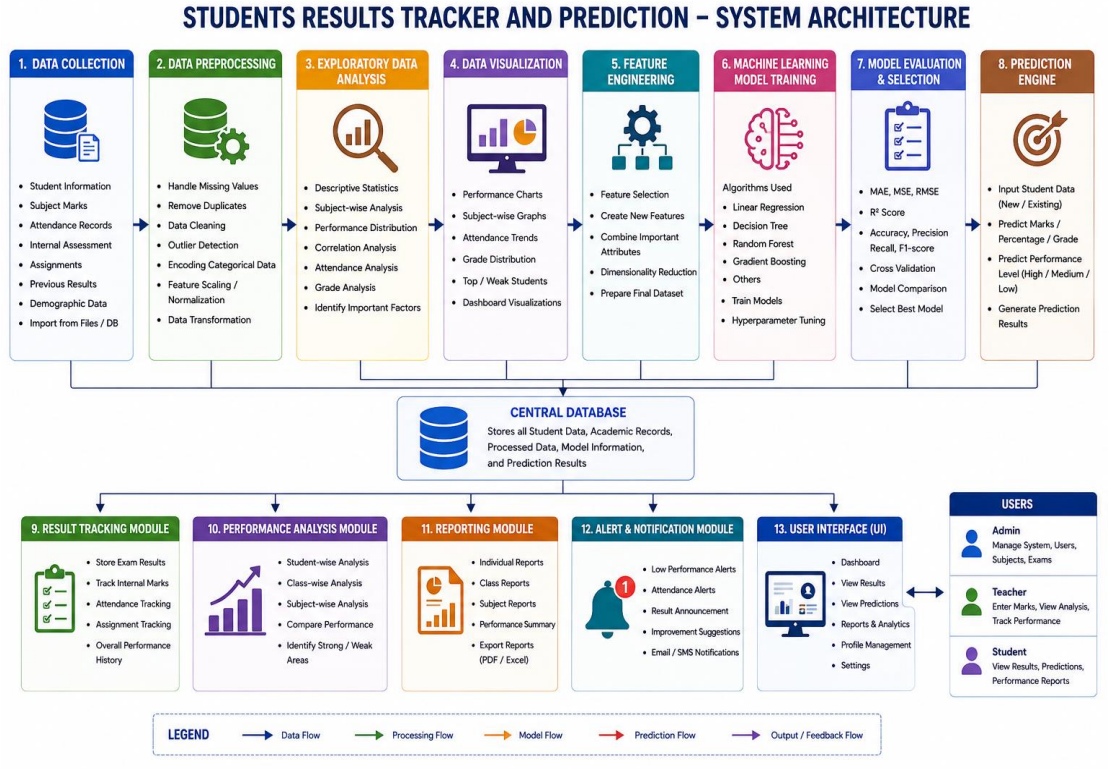
IV. Methodology

The methodology of the **Students Results Tracker and Prediction** system consists of several stages, beginning with data collection and ending with prediction and result visualization. First, historical student academic data containing marks, attendance, assignments, internal assessments, and examination results is collected. The dataset is

examined to understand its attributes, data types, missing values, and target variable. Data preprocessing is performed to handle missing values, duplicate records, inconsistent information, and categorical attributes. Categorical variables are converted into numerical representations using suitable encoding techniques when required. Exploratory Data Analysis is performed to understand student performance distributions and relationships between different academic factors. Data visualization techniques are used to identify subject-wise trends, grade distributions, attendance patterns, and performance variations. Relevant features are selected and prepared for training the machine-learning models. The processed dataset is divided into training and testing datasets for model development and evaluation. Different machine-learning algorithms such as Linear Regression, Decision Tree, Random Forest, and Gradient Boosting can be trained using the prepared data. The trained models are evaluated using MAE, MSE, RMSE, R^2, accuracy, precision, recall, or F1-score according to the prediction objective. Finally, the best-performing model is selected to generate predictions, and the results are displayed through a user-friendly dashboard containing student performance information, analytical charts, and prediction results. This workflow follows established student-performance prediction practices involving data collection, preprocessing, model development, evaluation, and application.

System Architecture

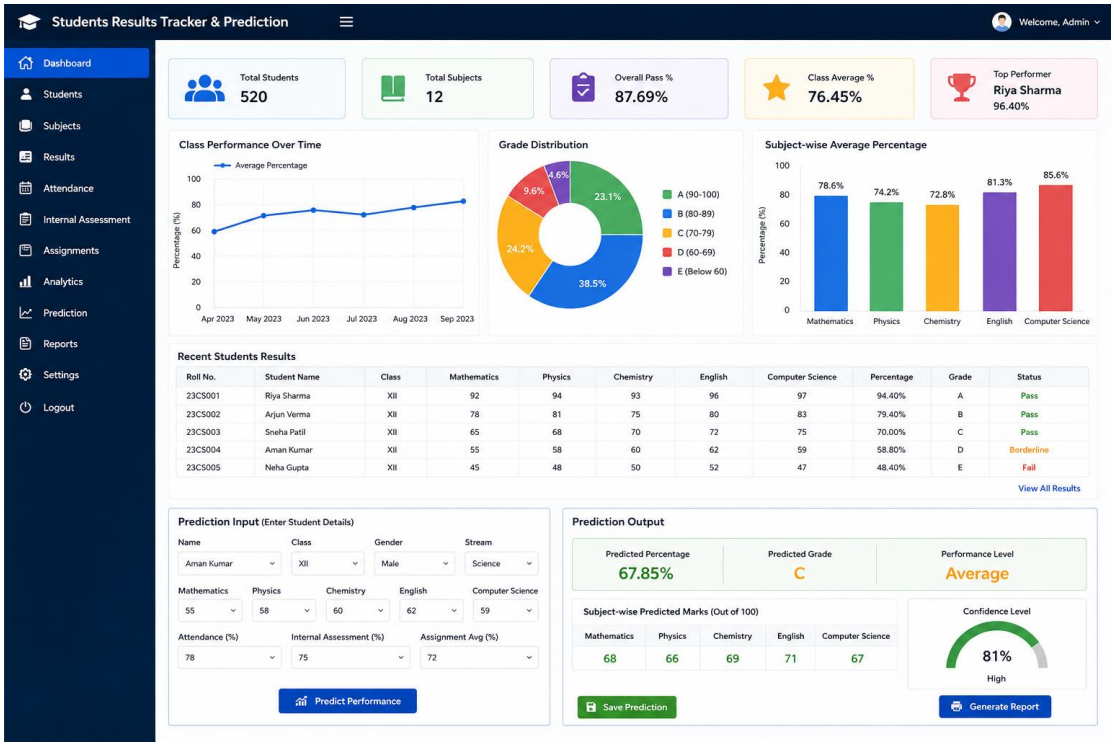
The Students Results Tracker and Prediction system architecture represents the complete flow of academic data from collection to final prediction and reporting.



The system starts with the Data Collection Layer, where student details, marks, attendance, assignments, and examination information are collected from academic records or datasets. The collected data is transferred to the Data Preprocessing Layer, where missing values, duplicate records, inconsistent information, and categorical

attributes are handled. The cleaned data is then passed to the Data Analysis Layer, where statistical analysis and exploratory techniques are used to understand student performance patterns. The Visualization Layer represents subject-wise marks, attendance, grades, performance trends, and other academic information through charts and graphs. The Feature Engineering Layer selects and transforms relevant academic attributes required for prediction. The processed data is provided to the Machine Learning Layer, where suitable regression or classification algorithms are trained using historical student records. The trained models are evaluated using appropriate performance metrics to select the most effective model. The selected model is connected to the Prediction Layer, which receives student information and predicts expected marks, grades, percentages, or performance categories. The Result Tracking Layer maintains individual student results and allows academic progress to be monitored over time. The Reporting Layer generates performance summaries, analytical reports, and prediction results for authorized users. Finally, the User Interface Layer allows students, teachers, or administrators to access results, view performance analysis, and obtain prediction results, completing the flow Data Collection → Preprocessing → Analysis → Visualization → Feature Engineering → Machine Learning → Model Evaluation → Prediction → Result Tracking → Reporting → User Interface. This architecture aligns with research workflows that emphasize preprocessing, feature selection, predictive modeling, evaluation, and practical application in student-performance prediction.

V. Result and Output



VI. Conclusion

The STUDENTS RESULTS TRACKER AND PREDICTION system provides an efficient and organized solution for managing, analyzing, and predicting students' academic performance. The system maintains important academic information such as

student details, subject-wise marks, attendance, assignments, internal assessments, grades, and examination results. By storing these records in a structured manner, the system reduces the effort required for manual result management and calculation. Data preprocessing techniques improve the quality of academic data by handling missing values, duplicate records, and inconsistent information. Exploratory Data Analysis and visualization help identify subject-wise performance, grade distributions, attendance patterns, and overall academic trends. Machine-learning algorithms can analyze historical academic records and predict students' future marks, grades, or performance levels. Different models can be evaluated using appropriate performance metrics to select a reliable prediction model. The prediction results can help teachers identify students who may require additional academic support at an early stage. Students can also use the system to understand their strengths, weaknesses, and expected academic performance. The dashboard provides clear charts, reports, and prediction results, making academic information easier to understand and monitor. The system can be further enhanced with personalized learning recommendations, real-time notifications, attendance alerts, and advanced machine-learning models. Overall, the project demonstrates how data analytics and machine learning can be combined with result tracking to improve academic monitoring, performance prediction, and data-driven educational decision-making.

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