International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue:3 Volume No.10 May - June – 2026
DOI:10.46647/ijetms.2026.v10i03.008 ISSN: 2581-4621

# Student placement prediction system using machine learning

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**Abstract**— The Student Placement Prediction System is a machine learning–based web application designed to predict the placement chances of students using academic, technical, and personal performance indicators. The primary objective of this project is to assist students, educators, and institutions in understanding the factors influencing employability and to provide data-driven insights for improving placement outcomes.
The system begins with the generation of a synthetic dataset consisting of student records with multiple features such as academic scores, technical skills, internships, projects, and extracurricular activities. This dataset is then used to train and evaluate multiple machine learning models, including classification algorithms, to identify the most accurate predictive model. The selected model is optimized using preprocessing techniques, feature scaling, and hyperparameter tuning to ensure reliable performance.
The trained model is deployed through a user-friendly web application built using Streamlit, which provides functionalities such as individual prediction, batch prediction through CSV uploads, and interactive data visualizations. The system also includes features like skill gap analysis, model performance insights, and automated PDF report generation. Additionally, email integration is implemented to allow users to send prediction reports directly via SMTP services.

## I. INTRODUCTION

Getting placed in a good company is one of the main goals for every student. But many students don't clearly understand what actually matters for placements. Some focus only on marks, some only on coding, and others try to do everything without proper direction. Because of this, students often feel confused about where they stand and what they need to improve.
At the same time, colleges also face difficulty in analyzing student performance in a structured way. It becomes hard to identify which students are ready for placements and which ones need more training. There is no simple system that combines all important factors and gives a clear prediction.
To solve this problem, this project "Student Placement Prediction System" is developed using machine learning. The idea is simple — instead of guessing, the system looks at different aspects of a student like CGPA, communication skills, technical skills, internships, projects, and other activities, and then predicts the chances of getting placed.
The main advantage of this system is that it doesn't just give a result, but also helps students understand their weak areas. For example, a student may have good academic scores but poor communication skills, which can affect placement chances. By identifying such gaps, students can focus on improving the right skills.

### 1.1 Objectives of the Project

The main objectives of this project are:
To develop a system that can predict student placement chances using machine learning
To consider multiple factors like academic performance, skills, and activities instead of relying on a single parameter
To help students identify their strengths and weaknesses through analysis
To provide a simple and user-friendly web interface for easy usage
To support batch prediction for analyzing multiple students at once
To generate reports and insights that can help in better decision-making
To assist colleges in understanding placement trends and improving training strategies

### 1.2 Outline of the Project

This project is divided into several parts, each handling a specific task:

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1. Dataset Preparation
A dataset is created with student details like marks, skills, internships, and other features. This data is used to train the model.
2. Model Training
Different machine learning algorithms are applied to the dataset. The best-performing model is selected based on accuracy and performance.
3. Web Application Development
The trained model is integrated into a web application where users can interact with the system easily.
4. Prediction Module
Users can enter student details, and the system predicts whether the student is likely to get placed or not.
5. Batch Processing
Multiple student records can be uploaded using a CSV file, and predictions are generated for all entries.
6. Visualization & Insights
Graphs and charts are used to show placement trends, feature importance, and model performance.
7. Report GenerationThe system generates reports based on predictions, which can be downloaded or shared via email.

## II. LITERATURE SURVEY

Many researchers have worked on predicting student placements using machine learning, and most of them agree that placements depend on multiple factors, not just academic marks.
Some earlier studies focused on using basic machine learning algorithms like Decision Tree, Naïve Bayes, and Random Forest to predict whether a student will get placed or not. These models were trained using past student data such as marks, skills, and experience, and their performance. From these works, it was clear that machine learning can give fairly accurate predictions when the data is properly prepared.
Later research improved this idea by testing more algorithms like Logistic Regression, Support Vector Machine (SVM), K-Nearest Neighbors (KNN), and Gradient Boosting. These studies showed that some models perform better than others depending on the dataset, and accuracy can go up to around 90% or more when proper preprocessing and tuning are done. This highlights that choosing the right model and cleaning the data properly is very important.
Some researchers also worked on combining multiple models (ensemble methods) to improve prediction results. These combined models were able to give better accuracy compared to single algorithms, showing that using multiple approaches together can make the system more reliable.
Another important observation from previous studies is that placement prediction should not depend only on academic scores. Many works included features like communication skills, internships, certifications, aptitude scores, and extracurricular activities. These factors were found to have a strong impact on placement outcomes.
There are also studies that focus on helping institutions, not just students. These systems analyze past data to identify trends and help colleges improve their training programs and placement strategies.
Even though many models have been developed, some limitations still exist. A few studies used small datasets, which may not give accurate real-world results. Others focused only on prediction but did not provide useful insights or suggestions for improvement.

## III. METHODOLOGY

The methodology of the Student Placement Prediction System follows a step-by-step process starting from data preparation to final prediction. First, a dataset is created containing student-related information such as academic scores, technical skills, communication ability, internships, and projects. Since real data is not easily available, a synthetic dataset is generated to represent real-

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world scenarios. After that, the data is preprocessed by handling missing values, converting categorical data into numerical form, and applying scaling techniques to ensure better performance of the model.

Next, multiple machine learning algorithms such as Logistic Regression, Random Forest, and Gradient Boosting are applied to the dataset. The data is divided into training and testing sets, and each model is evaluated using performance metrics like accuracy, precision, recall, and ROC-AUC score. The best-performing model is selected and further improved using tuning techniques. Once the model is finalized, it is deployed into a web application developed using Streamlit.

When a user enters student details, the system processes the input data in the same way as the training phase and generates a prediction about the student's placement chances. Along with prediction, the system provides additional features like visualization, skill gap analysis, report generation, and email sharing. This structured approach ensures that the system is both accurate and easy to use, making it practical for students and institutions.

## IV. SYSTEM DESIGN

The proposed Student Placement Prediction System is designed as a modular and scalable architecture that integrates machine learning with a web-based interface. The system is divided into two main parts: the model development phase and the deployment phase.

In the first phase, the dataset is prepared using student-related attributes such as academic performance, technical skills, internships, and other relevant factors. The collected data undergoes preprocessing, where missing values are handled, categorical variables are encoded, and normalization is applied. Feature engineering techniques are used to improve the quality of input data for better model performance.

Next, multiple machine learning algorithms are trained using the processed dataset. The models are evaluated using standard performance metrics such as accuracy, precision, recall, F1-score, and ROC-AUC. Based on these evaluations, the best-performing model is selected and optimized through hyperparameter tuning.

In the deployment phase, the selected model is integrated into a web application developed using Streamlit. The user interacts with the system through this interface by providing input data or uploading datasets. The prediction module processes the input using the trained model and generates placement predictions.

The system also includes additional modules such as visualization for understanding trends, report generation for creating downloadable outputs, and an email service for sharing results. This design ensures that the system is user-friendly, efficient, and capable of handling both individual and batch predictions.

Key Components of System Design

Data Layer: Handles dataset creation and storage
Processing Layer: Data preprocessing and feature engineering
Model Layer: Machine learning training and prediction
Application Layer: Web interface for user interaction
Output Layer: Results, visualization, and reports

## V. RESULTS

The proposed Student Placement Prediction System was evaluated using a dataset containing multiple student attributes such as academic performance, technical skills, internships, and extracurricular activities. The dataset was divided into training and testing sets in an 80:20 ratio. Multiple machine learning algorithms, including Logistic Regression, Random Forest, and Gradient Boosting, were implemented and compared to identify the best-performing model.

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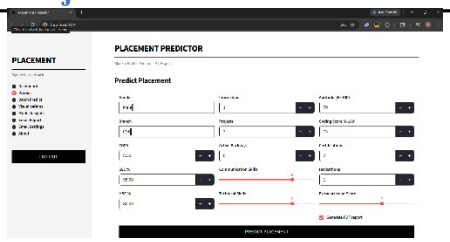


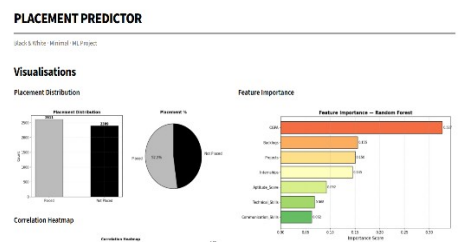


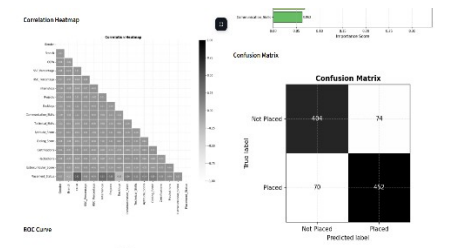


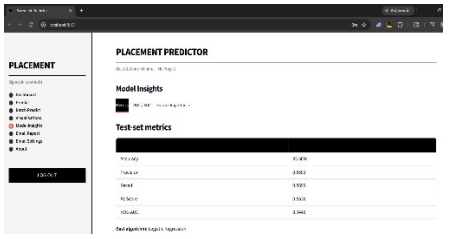


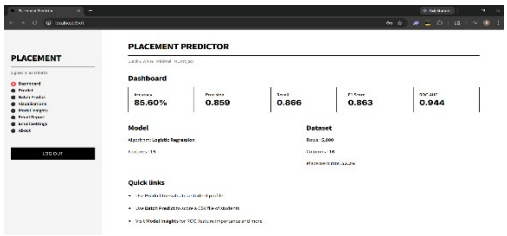


## VI. CONCLUSION

This project, Student Placement Prediction System, was developed to solve a common problem faced by students and colleges — understanding placement chances in a clear and practical way. Instead of depending on guesswork or focusing on only one factor like marks, this system considers multiple aspects such as academic performance, skills, internships, and other activities to give a better prediction.

Through this project, it is clear that machine learning can be effectively used in the education field to analyze student data and provide useful insights. The system not only predicts whether a student is likely to get placed or not, but also helps in identifying weak areas.

This makes it more helpful for students because they can focus on improving the right skills.

The web application makes the system easy to use, even for non-technical users. Features like batch prediction, visualizations, report generation, and email sharing make the project more practical and closer to real-world usage.

Overall, the project shows how technology can be used in a simple way to support better decision-making. It can be useful for both students and institutions in improving placement preparation and outcomes. In the future, the system can be improved further by using real-time data, more advanced

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models, and additional features to increase accuracy and usefulness.

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