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Bright Scope: College Experience Insights

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Abstract: Student feedback plays a key role in enhancing academic standards, campus infrastructure, and the overall learning environment. Traditional feedback methods are often manual, time-consuming, and susceptible to bias, making it difficult to derive meaningful insights. Bright Scope: College Experience Insights addresses this issue by applying machine learning-based sentiment analysis to categorize responses as positive, neutral, or negative. Leveraging Natural Language Processing (NLP), the system detects sentiment patterns and presents them through dynamic charts and detailed summaries. This empowers prospective students to evaluate institutions better and helps administrators identify areas for improvement. By fostering informed decision- making and improving communication between students and institutions, the platform contributes to a more responsive and transparent academic ecosystem.

Keywords: *Sentiment Analysis; Machine Learning; Natural Language Processing; Student Feedback; Educational Insights; Dashboards.*

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I. INTRODUCTION

Incorporating data analytics in education has made sentiment analysis an essential technique for evaluating student feedback as a critical tool for enhancing institutional effectiveness and student satisfaction. Institutions increasingly rely on sentiment analysis techniques, enabled by advancements in Natural Language Processing (NLP), to extract actionable insights from qualitative data. Such insights assist in pinpointing issues, improving service standards, and elevating student satisfaction [1], [2].

Applications of sentiment analysis have proven effective in evaluating various aspects of academic life, including instructional quality, campus infrastructure, and student engagement. The structured analysis of unstructured feedback provides educational institutions with a reliable foundation for data-informed decision-making and continuous improvement [3]–[6].

The proposed system, Bright Scope: College Experience Insights, offers a comprehensive sentiment analysis framework tailored to the education domain. This framework employs the Bidirectional Encoder Representations from Transformers (BERT) model, known for its superior contextual understanding and classification accuracy. The BERT model classifies student responses effectively into distinct sentiment categories such as positive, neutral, and negative across critical domains such as academics, faculty interaction, facilities, and campus life [1].

Output from the system includes interactive dashboards for prospective students and parents, as well as analytical reports designed for institutional administrators. These features promote transparency, facilitate informed decision-making, and support targeted improvements in institutional performance [2], [6].

Integration of deep learning models like BERT with educational data analysis establishes BRIGHT SCOPE as a scalable and insightful solution. The system contributes significantly to enhancing the student experience while aligning institutional strategies with real-world student perspectives.

II. OBJECTIVES

➢ *The Primary Objectives of this Research are:*

- To develop an automated sentiment analysis system capable of processing large volumes of student feedback with high accuracy.

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- To design an efficient feedback processing pipeline that delivers real-time sentiment analysis and insights.
- To present feedback analysis results through an interactive dashboard, enabling administrators to make data-driven decisions for institutional improvements.
- To enhance prospective students' and parents' decision-making by providing clear and accurate insights into the college experience.

III. RELATED WORK

The application of sentiment analysis in educational settings has gained significant attention in recent years. Various studies have explored different approaches to extracting insights from student feedback using Natural Language Processing (NLP) and machine learning.

A recent work [2] applied text-based classification with NLP techniques to analyze student feedback on institutional facilities. Although capable of recognizing sentiment trends, the method was limited by its lack of real-time analysis features and comprehensive visualization tools. The need for scalable, accurate sentiment models was highlighted as a key area for future development.

Another study [3] focused on evaluating qualitative student responses using sentiment categorization. It managed to convert qualitative feedback into sentiment labels, but faced challenges, challenges such as dataset diversity and ambiguous responses limited classification accuracy.

Research into machine learning applications for sentiment analysis [4] employed models like logistic regression and LSTM to classify feedback. However, difficulties in handling unstructured and noisy data persisted, suggesting the need for hybrid or deep learning-based approaches for improved performance.

In a broader context, earlier work [5] explored sentiment analysis in educational research using traditional NLP models. The study emphasized the value of feedback analysis but also pointed out limitations in interpreting subjective responses and delivering user-friendly insights.

Additionally, studies like [6] adopted lexical approaches to explore student sentiment but faced scalability and adaptability issues across varied institutions. More recently, transformer-based models have shown promise. A comprehensive review [1] outlined the advantages of using models like BERT for sentiment analysis, especially for capturing context in complex textual data.

This work extends prior research by addressing identified gaps and leveraging recent advancements. The proposed system advances beyond previous limitations by integrating a BERT-based framework for context-aware sentiment classification, combined with real-time visualization dashboards, scalable processing, and institution-specific customization.

IV. PROPOSED METHOD

The proposed sentiment analysis system follows a structured pipeline consisting of six key stages, as illustrated in Fig. 1.

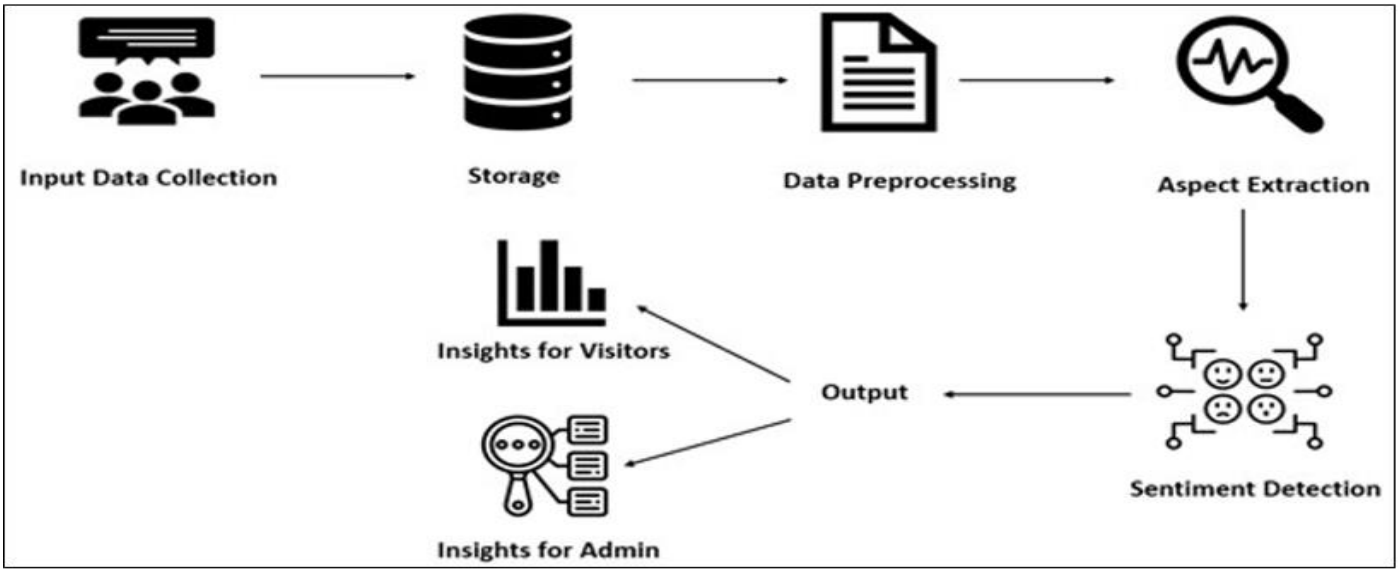

Fig 1 Schematic Diagram of the Proposed Model

➢ *Input Data Collection*

Student feedback is gathered using structured surveys that focus on core institutional aspects such as teaching quality, infrastructure, placements, and library services. A clustered sampling approach ensures relevance by collecting data from a specific educational institution.

➢ *Storage*

All feedback entries are securely stored in a centralized database. This approach ensures data integrity, simplifies retrieval, and supports scalability for larger datasets.

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➢ *Data Preprocessing*

Raw textual input is transformed through preprocessing steps to prepare it for analysis. The steps include:

- Converting text to lowercase
- Removing punctuation and stopwords
- Tokenization
- Applying stemming and lemmatization
- Key aspects such as teaching, infrastructure, and placements are also identified during this stage to enable focused analysis.

➢ *Aspect Extraction*

Relevant aspects or themes are extracted from the preprocessed text. This facilitates aspect-based sentiment analysis by evaluating feedback in relation to specific domains, thereby improving contextual accuracy.

➢ *Sentiment Detection*

After preprocessing, various techniques are employed for sentiment classification, including:

- Vectorization: Text is transformed into numerical format using Bag of Words (BoW), Term Frequency- Inverse Document Frequency (TF-IDF), and word embeddings (Word2Vec, GloVe).
- Model Training: Models such as Logistic Regression, LSTM, BERT, and RoBERTa are trained and optimized to detect sentiment accurately using early stopping, learning rate optimization, and hyperparameter tuning. Each feedback entry is then classified into positive, neutral, or negative sentiment categories.

➢ *Output Generation*

The output is divided into two user-specific insights:

- Insights for Visitors: A visual interface displays sentiment trends through interactive charts, helping students and parents understand public opinion about the institution.
- Insights for Administrators: A detailed dashboard provides deep analytics, enabling decision-makers to identify strengths and address areas requiring improvement based on real-time feedback patterns.

V. RESULTS AND DISCUSSION

The developed sentiment analysis system has been designed with a user-centric interface and robust back- end processing to extract actionable insights from student feedback. Each system component contributes to an intuitive user experience and facilitates efficient feedback evaluation. The outcomes of the system are described below.

A. Landing Page with Branding and Introduction

The interaction begins with a professionally designed landing page (Figure 2), showcasing institutional branding and a concise overview of the platform's purpose. The landing page includes clearly marked navigation buttons for login and registration, reinforcing credibility and encouraging user engagement.

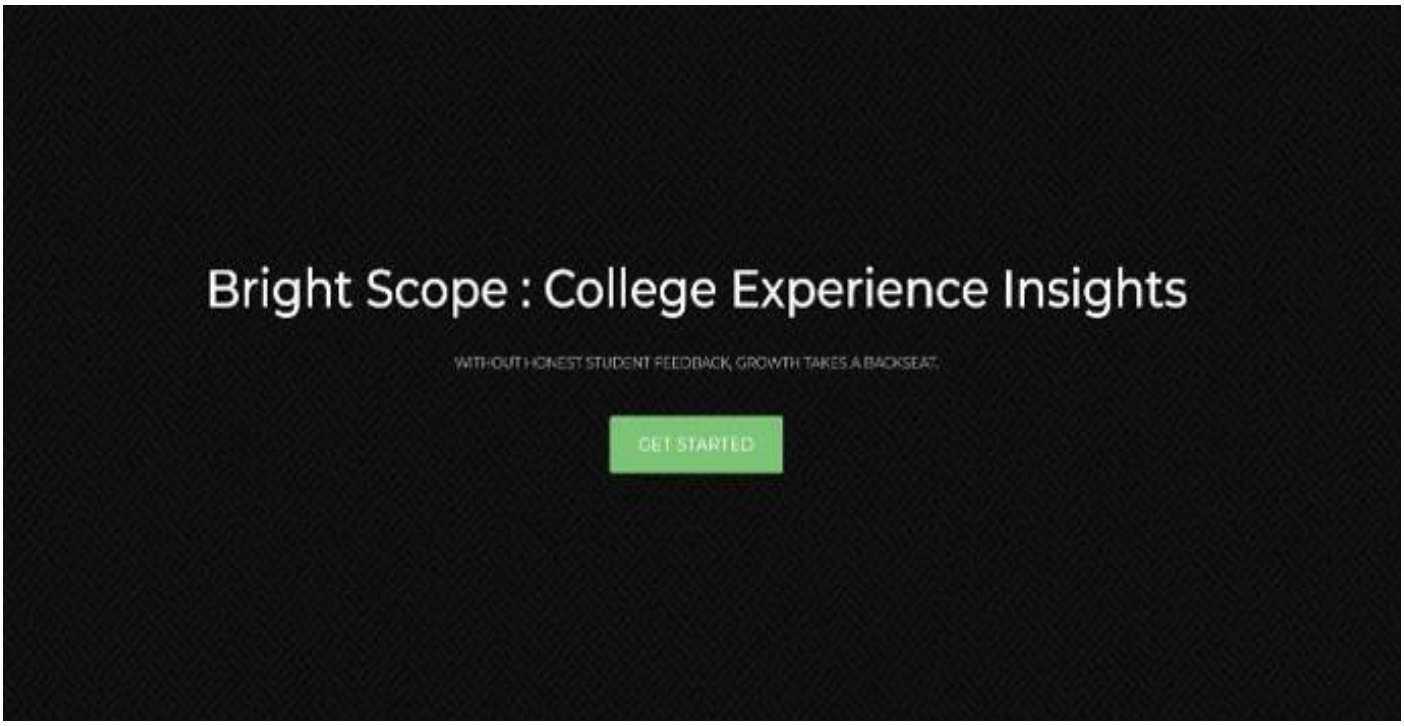

Fig 2 Landing page with branding and introduction.

B. Secure Login and Registration Interface

A secure and user-friendly authentication module (Figure 3) enables students to log in or register with ease. The interface ensures data privacy and account security, while offering a tailored experience to each user.

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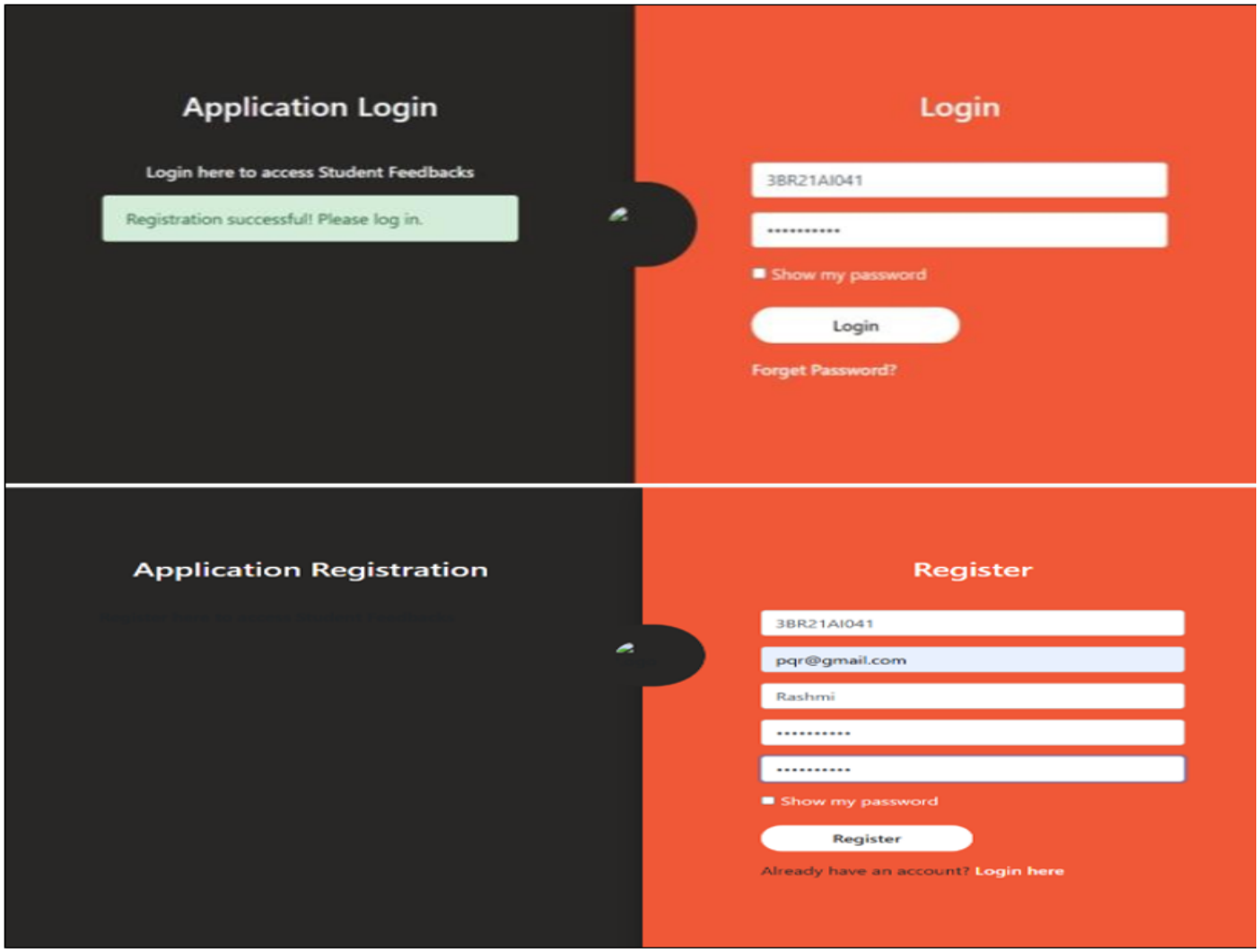

Fig 3 Secure login and user registration interface.

C. Student Dashboard: Centralized Access to Resources

Upon successful login, students are directed to a personalized dashboard (Figure 4). This dashboard acts as a centralized hub, presenting essential information such as placement statistics, brochures, and multimedia campus resources. The integration of academic and admission-related materials supports both current students and prospective applicants.

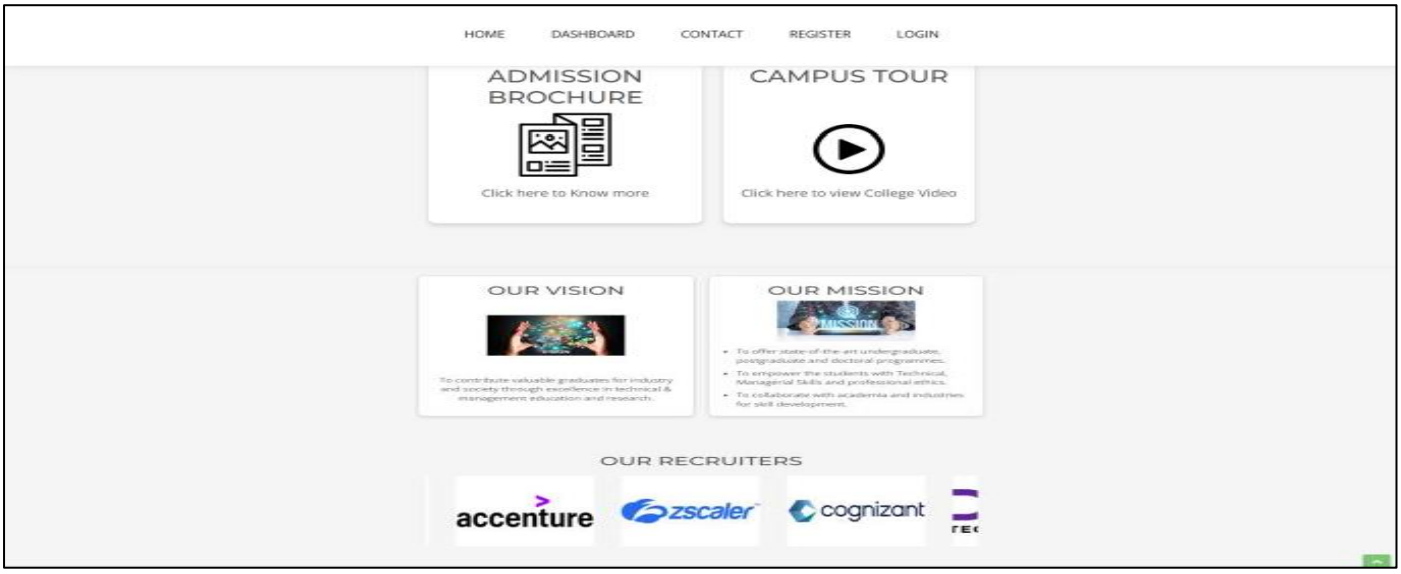

Fig 4 Student Dashboard Showcasing Key Information and Resources.

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D. Student Feedback Form Interface

The feedback form (Figure 5), embedded within the student dashboard, is visually appealing and easy to navigate. It encourages students to provide structured feedback on academic and infrastructural parameters. The simplified interface led to higher submission rates and ensured diverse, high-quality input from users.

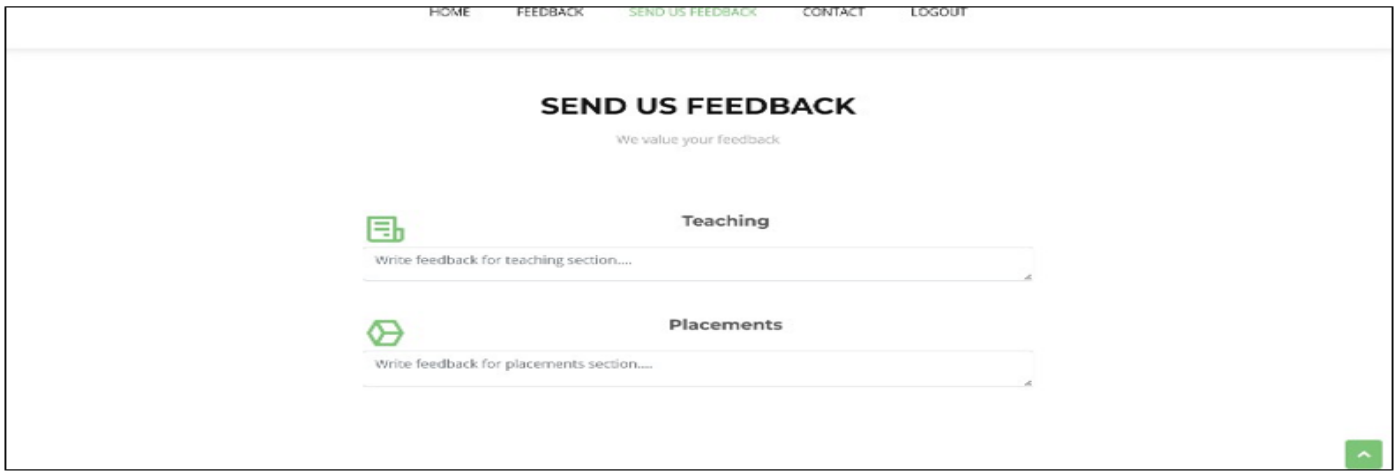

Fig 5 Student Feedback form Interface.

E. Sentiment Distribution Across Departments

After preprocessing and classification, the sentiments are categorized as positive, neutral, or negative using machine learning models. The analysis results are presented in a department-wise pie chart format (Figure 6), enabling quick identification of departments with strong or weak student sentiment.

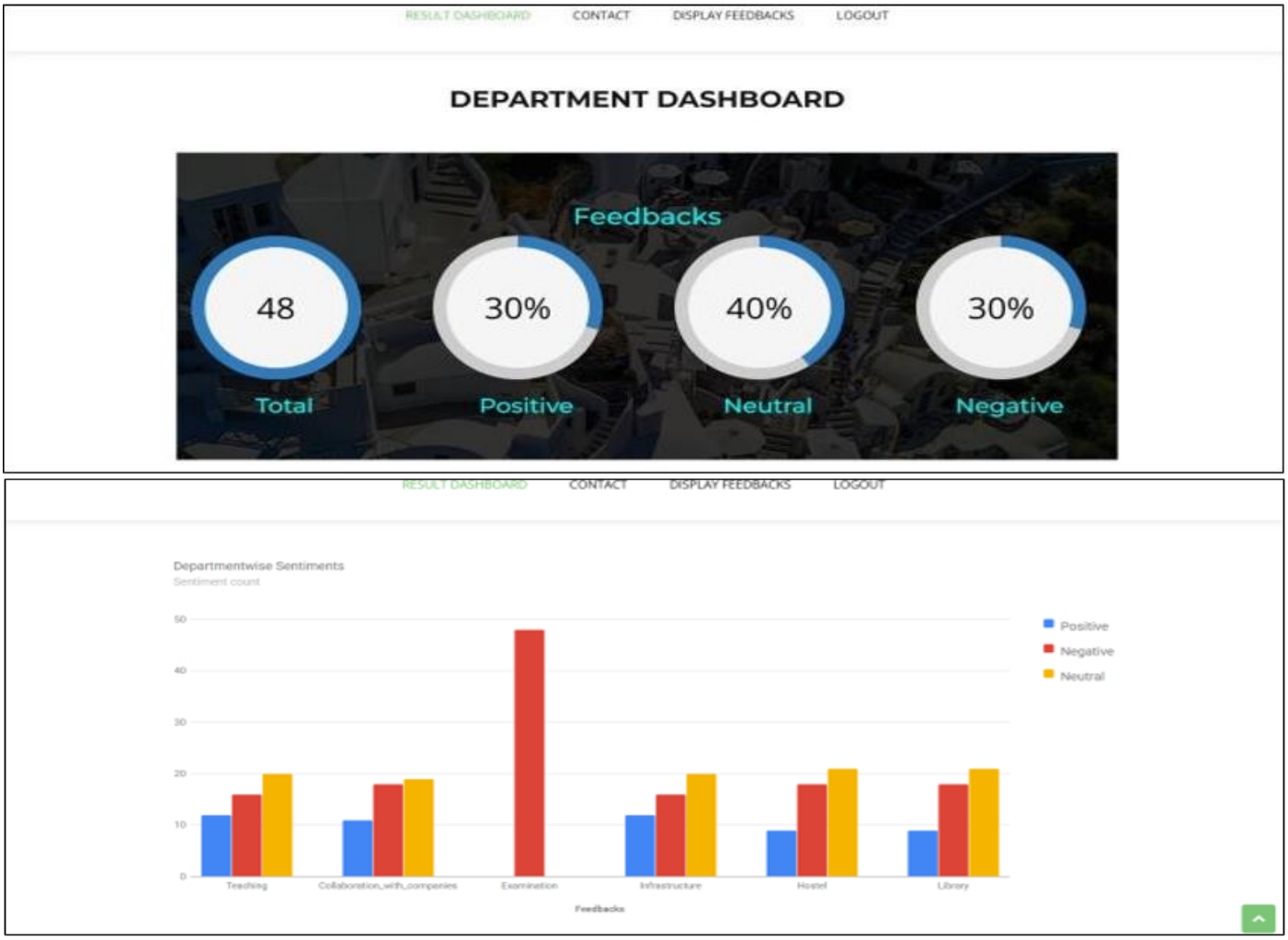

Fig 6 Sentiment Distribution Across Different departments.

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F. Staff Dashboard and Feedback Visualization

To support data-driven decision-making, the platform features a dedicated staff dashboard (Figure 7). It displays aggregated sentiment trends using visual aids, helping administrators to evaluate departmental performance and implement timely interventions where necessary.

Fig 7 Staff dashboard interface with sentiment visualization.

VI. CONCLUSION

The Bright Scope: College Experience Insights system provides an effective, data-oriented solution for analyzing and improving the college environment based on student feedback. By utilizing machine learning and sentiment analysis techniques, the platform interprets feedback to reveal meaningful insights into academic quality, infrastructure, placement services, and student satisfaction. Its real-time analysis capabilities and interactive dashboards enable institutions to make faster, more informed decisions. Throughout development, challenges such as improving sentiment classification accuracy and managing biased or inconsistent responses were carefully addressed, resulting in important lessons for system enhancement. Future improvements include integrating chatbot and voice-feedback options, incorporating predictive analytics, and fine-tuning the sentiment models for better precision. Overall, the system strengthens communication between students and administrators, supports continuous development, and holds promise as a standard feedback analysis tool for both academic and professional institutions.

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