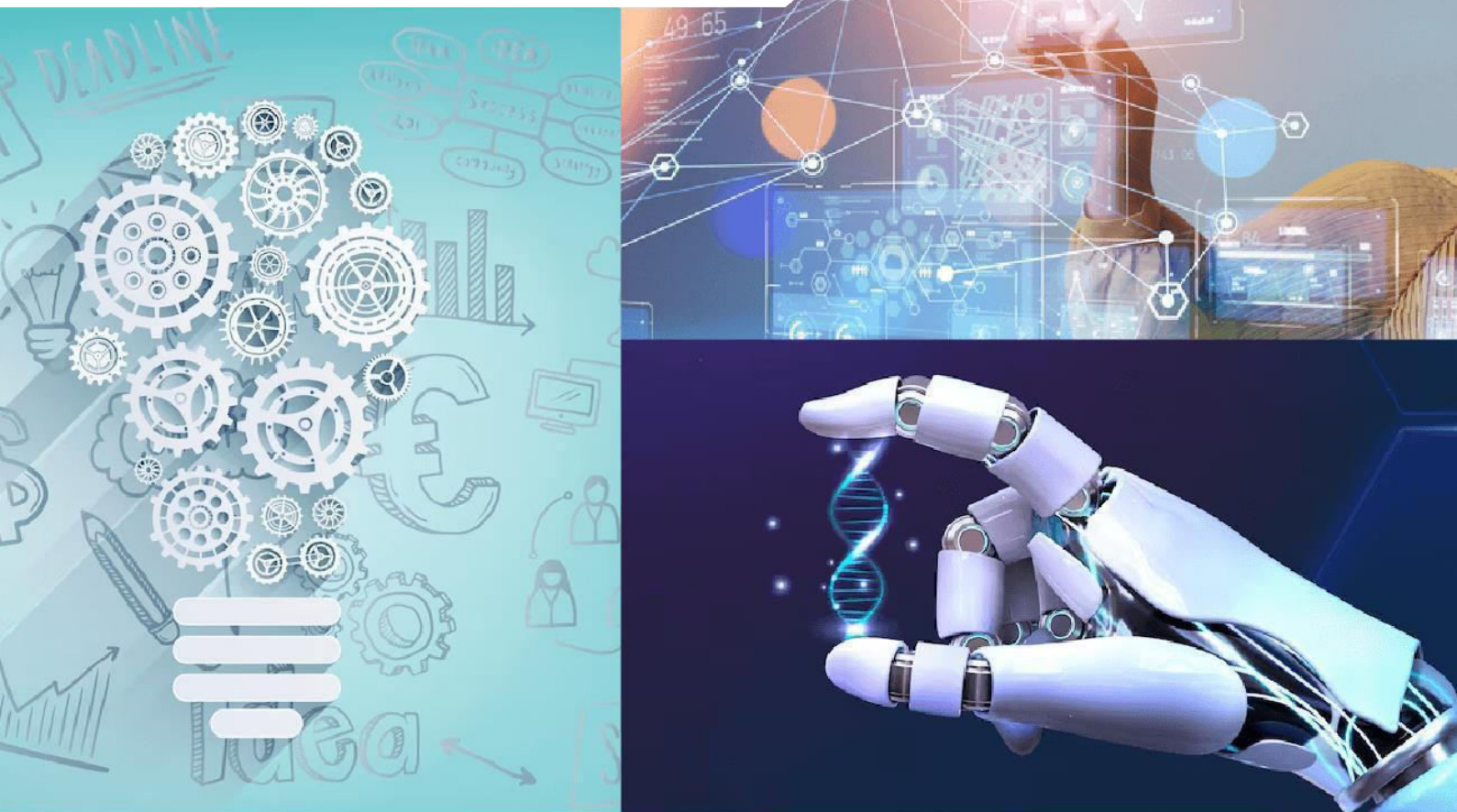




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Sentiment Analysis on Student Feedback Using SVM

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ABSTRACT: Student feedback is a critical component of the educational ecosystem, providing insights into teaching effectiveness and student satisfaction. Manual analysis of such feedback is time-consuming and prone to human bias. This paper presents an automated sentiment analysis system using Machine Learning. A web-based portal is developed using Flask to collect and process feedback efficiently. The system uses Term Frequency–Inverse Document Frequency (TF-IDF) for feature extraction and a Support Vector Machine (SVM) classifier to categorize feedback into positive, neutral, and negative sentiments. An administrative dashboard provides visualization of sentiment distribution and trends, enabling data-driven decision-making.

KEYWORDS: Sentiment Analysis, Student Feedback, Natural Language Processing, TF-IDF, Support Vector Machine (SVM)

I. INTRODUCTION

In educational institutions, continuous improvement in teaching methodologies depends heavily on student feedback. However, as the volume of feedback increases, manual processing becomes inefficient and unscalable.

Sentiment analysis, a subfield of Natural Language Processing (NLP), enables the classification of textual feedback into structured categories such as positive, negative, and neutral. This helps institutions understand student opinions more effectively.

This project aims to bridge the gap between unstructured feedback and actionable insights by developing a web-based sentiment analysis system. Students can submit feedback through a simple interface, while administrators receive analytical insights such as sentiment distribution, satisfaction levels, and performance trends.

II. LITERATURE REVIEW

2.1 Traditional Feedback Analysis Approaches

Existing systems for analysing student feedback primarily rely on manual evaluation or basic keyword-based methods. These approaches involve reading feedback individually or counting the occurrence of specific words such as “good” or “bad.” While simple, these methods are time-consuming, inconsistent, and prone to human bias. They also fail to capture the actual meaning of feedback when both positive and negative sentiments are present in the same sentence.

2.2 Machine Learning-Based Sentiment Analysis Systems

Recent research uses Machine Learning algorithms such as Naive Bayes, Support Vector Machine (SVM), and Logistic Regression for sentiment classification. These models learn patterns from labelled datasets and provide better accuracy compared to traditional methods. Feature extraction techniques like TF-IDF help convert textual data into numerical form, allowing models to effectively analyse large volumes of feedback.

2.3 Limitations of Existing Systems

Despite advancements, existing systems still face several challenges:

- Lack of automation in traditional methods
- Requirement of large labelled datasets for machine learning models
- Limited scalability for handling large volumes of feedback
- Lack of real-time analysis and visualization

Summary

The literature highlights the need for an automated system that can efficiently analyse large volumes of student feedback with high accuracy. A combination of Natural Language Processing and Machine Learning techniques provides a practical solution. Therefore, this project uses TF-IDF for feature extraction and Support Vector Machine (SVM) for sentiment classification to achieve better performance and scalability.

III. METHODOLOGY

The proposed system consists of two main components:

1. Web-based application
2. Machine Learning pipeline

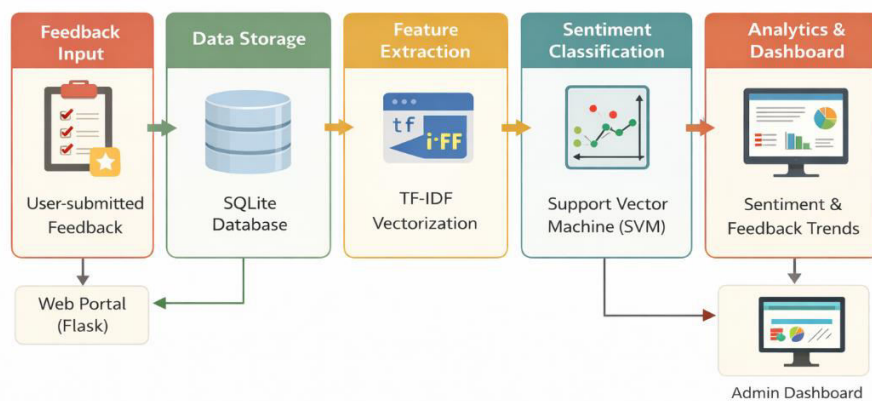


Fig 3.1: System Architecture Diagram

3.1 Data Collection and Web Application

The system is developed using the Flask web framework and includes the following features:

- **User Authentication:** Secure login and registration for students and administrators
- **Feedback Submission:** Students can submit textual feedback for teachers and courses
- **Data Storage:** Feedback data and results are stored using SQLite database

3.2 Machine Learning Pipeline

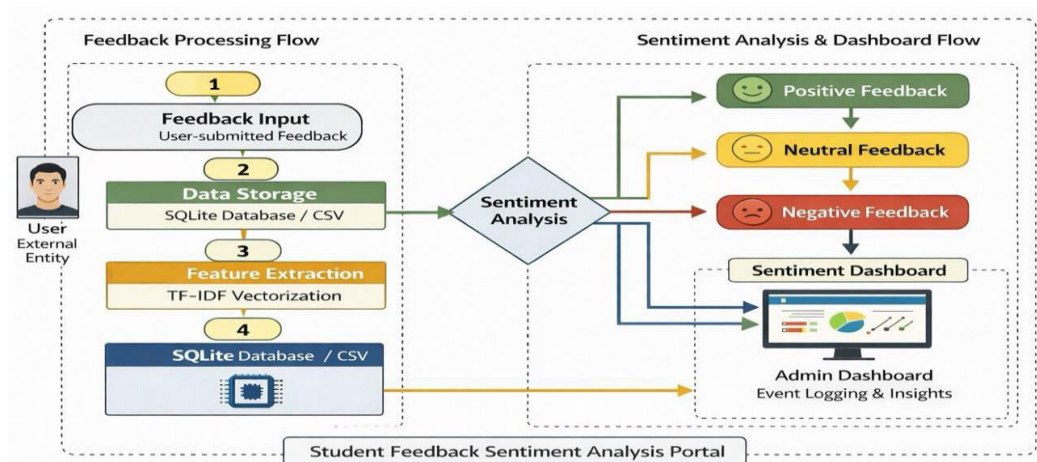


Fig 3.2: Sentiment Analysis on Student Feedback Flowchart

Step 1: Data Preprocessing

- Convert text to lowercase
- Remove stop words (e.g., "the", "is")

- Remove punctuation and unwanted characters
- Perform tokenization

Step 2: Feature Extraction (TF-IDF)

- Convert text into numerical vectors using TF-IDF
- Assign importance to words based on frequency and relevance
- Helps machine learning models understand textual data

Step 3: Model Training (SVM)

- A Support Vector Machine (SVM) classifier is trained on TF-IDF features
- The model learns patterns from labelled data
- It classifies feedback into:
 - Positive
 - Negative
 - Neutral

3.3 Analytics and Dashboard

The system includes an admin dashboard to visualize results using Python libraries such as Pandas and Matplotlib:

- **Sentiment Distribution:** Pie charts and bar graphs showing feedback categories
- **Trend Analysis:** Feedback trends over time
- **Keyword Insights:** Important words identified using TF-IDF
- **Satisfaction Score:** $\text{Satisfaction Score} = (\text{Positive} + 0.5 \times \text{Neutral}) / \text{Total} \times 100$

This helps administrators quickly understand student opinions and take necessary actions.

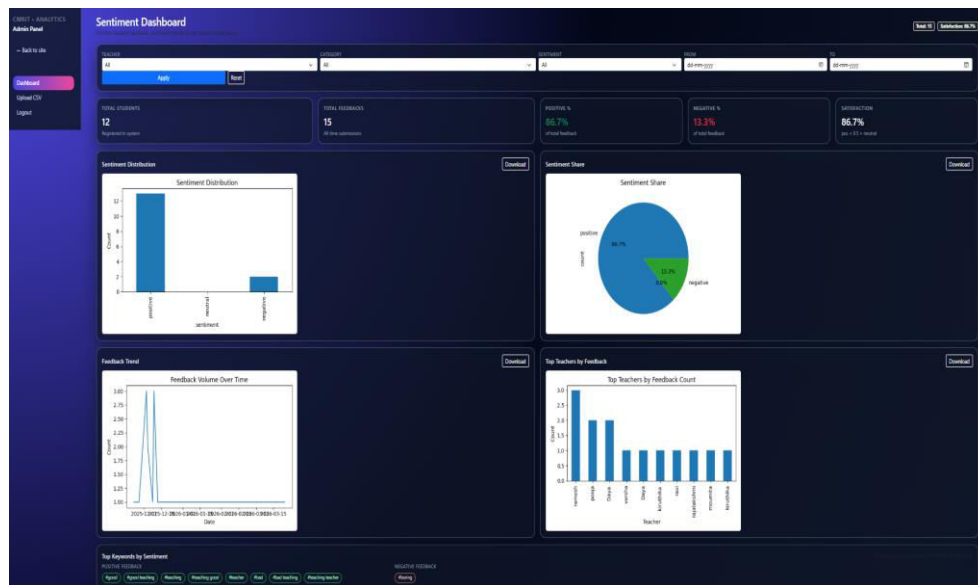


Fig 3.3: Dashboard Showing Sentiment Distribution, Feedback Trends, and Analytics

IV. RESULTS AND DISCUSSION

The system was tested using a sample dataset of student feedback.

- The model successfully classified feedback into positive, negative, and neutral categories
- Visualization tools helped in identifying trends and patterns
- Compared to manual analysis:
 - Faster processing
 - Reduced human bias
 - More consistent results

The system performs efficiently and improves as more data is added.

V. CONCLUSION

This project demonstrates the successful implementation of a sentiment analysis system for student feedback using Machine Learning techniques. By integrating TF-IDF for feature extraction and Support Vector Machine (SVM) for classification, the system effectively categorizes feedback into positive, negative, and neutral sentiments, providing accurate and meaningful insights.

The developed web-based application using Flask ensures a user-friendly platform where students can easily submit feedback and administrators can analyse results through visual dashboards. This automation significantly reduces manual effort, eliminates human bias, and improves the efficiency of feedback analysis.

Overall, the project highlights the importance of combining Natural Language Processing and Machine Learning to transform unstructured textual data into valuable insights, thereby enhancing the quality of education and institutional performance.

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