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Smart Action Oriented Student Feedback System

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Abstract: The Full Stack Student Feedback Collection, Evaluation and Reporting Platform is a web-based Application designed to systematically collect, analyze, and present student feedback in an actionable format for academic improvement. The platform is developed using React-JS for the Client-side interface, Java Spring Boot for backend services, and a relational database for Persistent data storage, and Spring Boot reference Implementations by adapting core entities to Student and Feedback. Updating the system with various applications with the integration of an Action-Oriented Feedback Insight Engine, which is automatically, evaluates both quantitative ratings and quality textual feedback's from the students. The engine uses sentiment classification, keyword-based model extraction, and trend analysis techniques to transform raw feedback into simple, actionable insights and understandable by the faculty members. Instead of presenting only numerical scores, this platform will generates clear recommendations highlighting strengths, areas for improvement where the faculty members are low, and recurring student feedback's. The system ensures structured feedback of that particular faculty, efficient data processing and meaningful visualization of outputs from the students through faculty dashboards and analytical reports. By reducing manual interaction efforts and enabling data-driven from the platform to make a decision, this platform will supports the faculty to continuous improvement in teaching and providing a quality academic delivery. The proposed solution demonstrates a scal- able, real-world application of full stack development concepts and enhances traditional feedback systems by bridging the gap between feedback collection and effective action.

Index Terms: Java Spring Boot, ReactJS, MySQL, Action- Oriented AI-Bot

I. INTRODUCTION

In any level of education institutions, student's feedback serves is an fundamental tool, which is used to evaluate teaching quality, teaching effectiveness of every teacher, and overall academic experience for that current academic. Education institutions routinely collect feedback at the end of academic year to evaluate student perceptions and identify areas for improvement. Despite its importance, the effectiveness of feedback systems largely depends on how the collected data is processed and utilized.

In early days feedback systems are used to represent the numerical ratings and some advices to the teachers. Numerical ratings provide a quick overview in, they often lack contextual depth. In olden days feedback is an feedback that contains opinion of every student but it remains unstructured so that it is difficult to analyze progress of each & every Teacher. Teachers are required to read manually through comments in hundreds, then the above mentioned process is an time-consuming.

With the advancement of web technologies and data analytics, there is an opportunity to enhance feedback systems by integrating automated analysis and visualization techniques. Through this Full stack web development it enables the creation of scalable, interactive platforms that can handle data collection, processing, and reporting efficiently. Here we also introduce basic natural language processing (NLP) techniques such as sentiment analysis and keyword extraction can significantly reduce manual interpretation effort [2], [4].

This project introduces a student feedback platform that not only collects feedback but also converts it into understandable insights to the Faculty members. The proposed system aims to bridge the gap between feedback collection and effective academic action by providing faculty members with clear, data-driven recommendations.

II. LITERATURE REVIEW

Basically several reviews has highlighted the importance of student feedback in improving teaching effectiveness [1], [11]. Existing feedback systems are generally categorized into survey-based tools, learning management system (LMS) integrations, and standalone evaluation platforms. While these systems successfully collect data, their analytical capabilities are often limited.

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Research on educational analysis emphasizes the role of sentiment analysis and text mining in extracting meaningful information from student opinions [2], [4], [10]. Keyword- based approaches are widely used due to their simplicity and interpretability and makes faculty to understand. However, many academic institutions still depend on manual analysis or basic summaries like graphically, numerically & systematically.

Recent advancements in full stack development frameworks such as React and Spring Boot have enabled the creation of modular, scalable applications [5], [14]. in28minutes provides reference implementations that demonstrate best practices in building RESTful services and frontend interfaces. This re- search builds upon these implementations and extends them by incorporating an action-oriented insight engine tailored for educational feedback analysis.

In recent advancements in full stack development is enable to the create the scalable web applications that integrate frontend interfaces, backend services, and intelligent analysis engines. Despite this progress, is an limited research that focuses on end-to-end systems that combine feedback's from the students, automatic analysis, and visualizing in a unified platform. This paper addresses this gap by proposing an integrated full stack solution with an action-oriented insight generation approach.

III. METHODOLOGY

The proposed system follows a modular architecture that combines feedback data collection with automated analysis and reporting. The methodology consists of dataset prepa- ration, preprocessing, network architecture design, training configuration, and evaluation.

A. Dataset

- The dataset consists of student feedback collected through structured online forms. Each feedback entry includes:
- Reasonable ratings (e.g., teaching effectiveness, course content, interaction)
- Qualitative textual comments provided by students
- Metadata such as course name, faculty name/unique ID and academic time table.
- The data in the dataset will stored in a relational database, enabling the data with efficient querying techniques and analysing across multiple acadamic years.

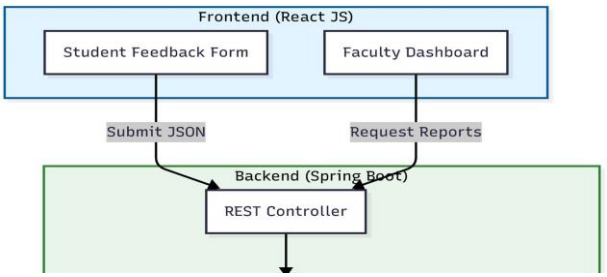

Fig. 1: System architecture diagram

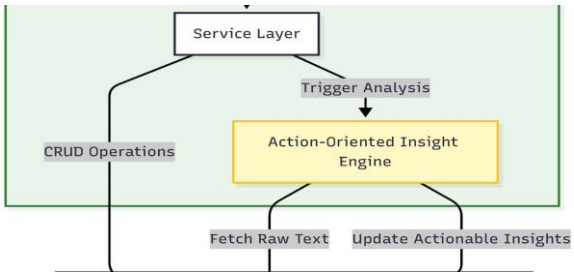

Fig. 2: Data flow diagram

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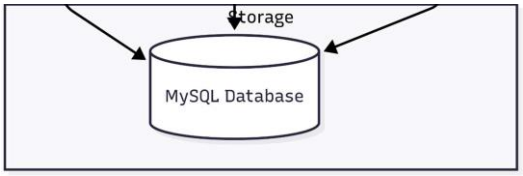

Fig. 3: Database schema

B. *Pre-processing*

Pre-processing is an technique which is used to applied to the textual feedback to improve the accuracy to analysis. The steps include in this technique are:

- Converting of text to required format like lowercase, uppercase.
- Removing of punctuation, numbers, and special charac- ters.
- Tokenization of sentences into individual words
- Removal of stop words
- Stemming or lemmatization or converting in to normalize and understandable words.
- Quantitative ratings are normalized to ensure consistency across different feedback forms.

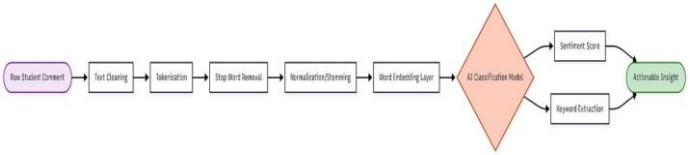

Fig. 4. Text preprocessing pipeline

C. *Network Architecture*

The feedback insight engine uses a light weight text- classification architecture suitable for real-time analysis. The architecture includes several steps to follow & those are:

- An input layer that receives pre-processed text tokens.
- An embedding layer to represent words in numerical form.
- A sentiment classification layer is the layer that categorizes feedback as positive, neutral, and negative according to the student feedbacks.
- A keyword extraction is an model that identifies fre- quently and repeated occurring feedback's and contextually feedback's given by the students.
- The architecture is designed to be modular so that addi- tional NLP models can be used in the future models to generate the reliable feedback to the faculty.

D. *Training Configuration*

The model is trained using labeled feedback data with known sentiment classes. Training configuration includes several functions and those are:

- Optimizer: Adam.
- Loss function: Categorical cross-entropy is an function which is used reduce the integrity.
- Batch size: the size is nothing but the number of students are participating in feedback section.
- Epochs: Selected based on convergence behavior of the student.
- Training is performed offline, while inference is con- ducted in real time during feedback analysis.

E. *Evaluation Metrics*

The performance of the sentiment classification model is evaluated using Accuracy, Precision, Recall, F1-score. These are the metrics to calculate the performance of the models, they are used to evaluate machine learning classification models, such as sentiment analysis classifiers. Each & every metrics has their own calculating formulas to analysis the statements.

- **Accuracy**
  - Measures the overall correctness of the model.
  - Overall percentage of the model to predict the correct predictions.

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- **Precision**
  - Measures how many of the predicted positive senti- ments are actually positive.
  - Precision of the predicted statements are actually positive or negative.
- **Recall**
  - Measures how many actual positive sentiments were correctly identified.
  - How many actual positive sentiments are correctly identified.
- **F1-score**
  - The harmonic mean of precision and recall.
  - Balance between precision and recall the statements.

IV. RESULTS

The Student Feedback Collection, Evaluation and Reporting Platform was successfully executed and tested with the students in the year. The system has collected both ratings and feedback from students using web applications by frontend services and stored in the relational database securely using backend applications. Faculty members were able to access the dashboards summarized feedback for their related courses, confirming the correct functioning of the frontend, backend, and database integration.

The Action-Oriented Feedback Insight Engine effectively and statistically analyzed numerical ratings to compute aver- ages, trends, and performance patterns, while textual feedback was processed using sentiment classification and keyword- based theme extraction [2], [4]. The system accurately identified strengths, areas requiring improvement, and recurring student concerns. The generated insights were aligned with overall feedback, demonstrating the feedback in reliability of the analytical process.

Overall, the results are shown in the proposed system successfully transforms raw student feedback data into meaningful, actionable insights for the feedback. Compared to tra- ditional feedback systems, the platform significantly increase manual interaction effort of student and supports data-driven and decision-making, thereby contributing to continuous improvement in teaching quality and academic delivery for the Faculty members.

V. DISCUSSION

The results of this project show that using full stack web technologies with automatic feedback analysis helps in under- standing student feedback better [5], [14]. Unlike traditional systems that only show raw marks and comments, this system analyzes both ratings and written feedback given by students. It then provides useful information to faculty members, which helps them improve teaching and make better academic decisions.

The Action-Oriented Feedback Insight Engine successfully finds repeated feedback, common student problems, and over- all performance trends [2], [4]. It matches numerical ratings with sentiment analysis to check the reliability of feedback. By showing strengths and areas that need improvement in simple dashboards, the system reduces the manual effort of faculty and helps them take timely actions.

Although the system works well, it has some limitations, such as using basic sentiment analysis and limited advanced language processing. However, the system design allows future improvements. Overall, this project provides a simple and effective solution to improve teaching quality using student feedback.

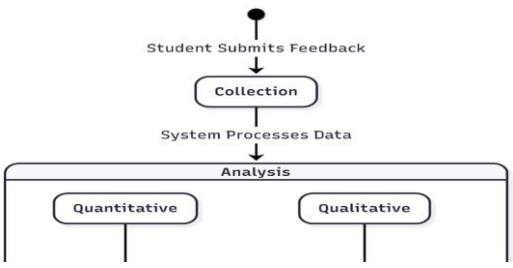

Fig. 5. Faculty dashboard interface

VI. CONCLUSION

This project successfully created a student feedback system that helps teachers to understand and what students think about that particular subject and teaching to that subject by faculty member. The system collects both numerical ratings and written comments from the students and processes it to give clear and meaningful information to the faculty members. The Action-Oriented Feedback Engine helps the faculty members to find common problems, repeated feedback, and common comments in student feedback's [2], [4]. By analyzing both numbers

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and text given by the students, it gives teachers a better view of strengths and defaults that are needed to be improve.

The dashboard displays all the results in a simpler way that understandable by the faculty members, making it easy for teachers to read and understand. This will decreases the time and effort of teachers that need to spend on analyzing feedback manually.

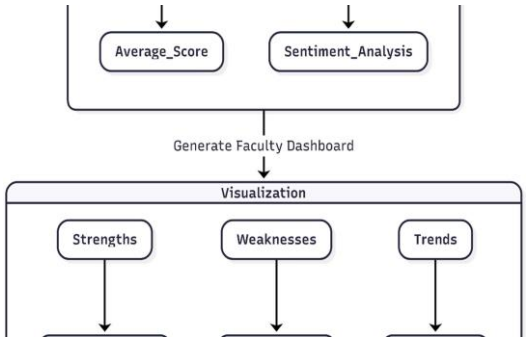

Fig. 6: Feedback analysis visualization

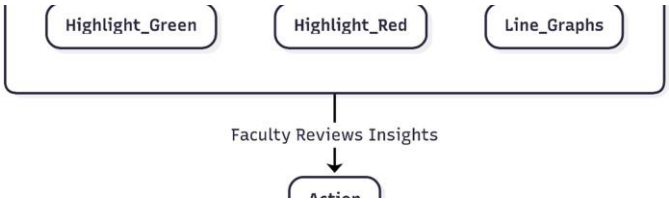

Fig. 7: Actionable insights report

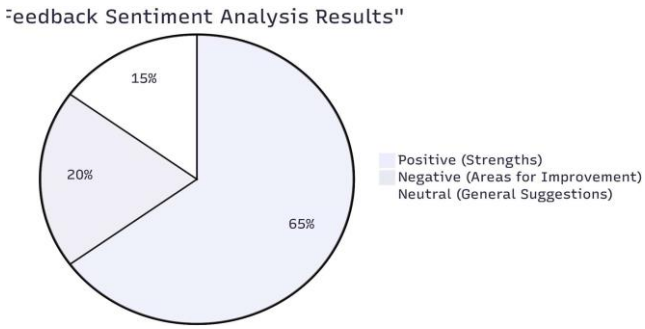

Fig. 8: Performance trends over time

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