Student Grievance Management System with Automated Escalation and Administrative Performance Monitoring.

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Abstract — Managing student grievances effectively is important for educational institutions because it directly plays a role in student satisfaction and institutional transparency. Most institutions still using non formal processes like email, online forms, or manual register to manage complaints. Because of these reasons institutions track complaints poorly, provide responses late, and lack responsibility in resolving student issues. To overcome these problems, our paper proposed a keyword based Student Grievance Management System to enhance with registering, tracking, and resolving student complaints. In this proposed system, we implement a structured database design to store all records related to each grievance, history log related to an individual grievance, and all individuals (students and administrators) involved in the resolution of each complaint. The system will automatically identify the appropriate department to handle a grievance based on the description of the grievance using a simple keyword based analysis method. It also assign severity levels to each grievance and have built-in escalation methods if a grievance is not resolved within the specified time.

Keywords — Student grievance system, Database management system, Automated escalation, Keyword-based complaint classification, Administrative monitoring, Higher education systems

I. INTRODUCTION

There are many potential problems that students encounter while studying at institutions of education. While some of the issues include academic problems, hostel facilities, test scores, infrastructure issues, transport services and administration process. Many students report these types of issues to their teacher, or the office of their department, or the office of administration. Many institutes still process complaints informally through conversation, written complaints, and emails. Because many complaints are improperly recorded or documented. Therefore, it is difficult to track the progress of complaints and resolve them in a timely manner. Another issue with the traditional way of handling grievances is the lack of a centralized method to manage the data relating to the complaints. If complaints are being recorded manually or kept in several different systems, the retrieval of information related to complaints can be challenging for administrators to do. For instance, administrators may not be able to determine how many complaints were received, which departments have more issues and how long it takes for the complaints to be resolved. The traditional grievance resolution process is-without sufficient tracking and storage of data is slow and invisible to the students. By providing an efficient method of organizing this data, Database Management Systems (DBMS) can be used to effectively facilitate the organisation of all relevant information within a well-designed database. Structured tables in a well-designed database can hold information about students, complaints made by students, administration actions taken to resolve the complaints and the history of resolutions of complaints. This allows organisations to maintain reliable records and retrieve information required when required. By using normalisation, as well as placing primary and foreign keys in relational databases, these factors helps to maintain the integrity and consistency of the Data. As such, DBMS is essential for building a reliable grievance management system. In addition to database management techniques that increase the effectiveness of handling complaints, the use of simple AI (Keyword based) approaches can assist in this as well. The system can determine which department the grievance should be routed to, and how serious an issue is, as soon as a student submits a grievance based on a description provided in their grievance. Therefore, the complaints are sent to the right authority quickly and reduce the amount of time it takes for administrators to work on complaints manually. In addition, if a complaint does not receive a response within a predetermined period, then the system can escalate the complaint to the next level of authority automatically through an escalation process. To address the above-mentioned problems, this project will create a Student Grievance Management System with Automated Escalation and Administrative Performance Monitoring. Through the online portal that is designed for this system, students will be able to submit a complaint, check on the status and progress of the complaint, and review the resolution history for the complaint. The grievance records for all complaints will be maintained in a central, relational database. The system will automatically rank all grievances by using an

analysis of the keywords assigned to grievances and assign a grievance to a department. The above described system provides reliable assurance that solutions are found for student's issues quickly. Once the specified time period has elapsed without a resolution, the complaint is sent to supervisors at higher levels within the organization (i.e., department heads or other institutional administrators). The system also provides an administrative dashboard which allows administrators to monitor performance and track the number of complaints received and solved.

The rest of this paper is organized in the following manner: Related research on grievance management and complaint resolution is addressed in Section 3, a description of the proposed system can be found in Section 4, Section 5 contains a general architecture of the proposed system, Section 6 focuses on the design of the database , Section 7 outlines how complaints will be classified and how they will be escalated, Section 8 presents details surrounding the implementation of the new system, Section 9 includes the results obtained while testing our new system. Finally, the conclusion of the paper is provided in Section 10 and addresses limitations of the study and future development of the proposed system.

II. LITERATURE REVIEW

Many different research papers have looked into using both a database system and an electronic platform (like a website) for managing complaints and grievances in a variety of business types. Most research looked at creating a centralised complaint registry that provides a way for users to submit complaints through an online user interface (like using a website). Most of the research conducted on this topic studied the use of relational database management systems to store a complaint and retrieve information from there to assist companies in storing their complaint information and tracking how successful they were in resolving a complaint[1]. Some researchers also suggested implementing web-based complaint management systems for educational institutions. These systems would allow students to submit their complaints via the web instead of writing them down in a physical complaint registry. The advantages of these types of studies primarily included being able to produce reports for the administration to review grievance data therefore having all the grievance records in one central location. However, the vast majority of the studies performed relied on administrative staff to sort and categorize the complaints that were received and therefore increasing the amount of time that administrative staff would spend waiting for responses from the business.[2],[3]. In recent years, many studies have focused on the use of automated methods for managing complaints. For instance, some studies have developed algorithms that allow for complaints to be automatically directed to the appropriate department based on an analysis of its content using a rules-based approach. Although these methods have improved the speed and accuracy of complaint routing, they rely on established guidelines rather than the careful review of the actual complaint description [4]. In addition, there have been studies that have analysed the description of a complaint and identified relevant categories of services using simple natural language processing techniques. These techniques perform keyword matching or text mining techniques to identify the type of complaint from the description. Even though they are not as complex as employing machine learning methods [5], [6]. These techniques provide an excellent way to identify a customer request quickly and consistently without requiring significant computing resources. The use of relational database management systems has been critical in managing complaints. Researchers have noted the importance of maintaining data integrity through the use of relational database management systems. An efficient manner in which to retrieve and maintain the data is through use of foreign keys, with the appropriate use of data standardization of foreign key and unique identification of complaints [7]. Database formats are also available to deliver analytical reports for administrators in support of decision making at the institution based on multiple database systems. There are also methods in the literature for managing hierarchical complaints. Under some systems that permit multi-level complaint management, when a complaint is unresolved after an investigation, it will automatically be forwarded to higher authorities. This process improves accountability and guarantees complaints will not be ignored at any administrative level [8][9]. In addition, most of the existing systems are reliant on human escalation of complaints by the administrators rather than time-bound automatic escalation. Studies have recently shown that it is vital to monitor the performance of administrators in managing complaints via complaint management systems. By tracking how many complaints each administrator has addressed and for how long, institutions will be able to assess the efficacy of their grievance redressal process and group areas for improvement into specific categories [10].

Many digital grievance solutions presented thus far lack sufficient levels of automatic integration and monitoring capability, therefore they typically provide only basic complaint filing platforms or some form of database administration functionality, and do not provide either complex classifications of complaints or automatic escalation procedures based upon said classification. Hence it is important to develop a system that combines an appropriately structured database architecture with the appropriate level of administrative monitoring capability to enable the classification and escalation of complaints. As a means to overcome these limitations, the AI-assisted Student Grievance Management System proposes to integrate a relational database structure with an automated grievance classification, and develop a time-based escalation mechanism for complaint resolution. In addition to providing the aforementioned functionality, the Student Grievance Management System provides administrative performance standards and will assist organisations understand how effective their grievance management processes are and how transparent they are to those who use them.

III. PROPOSED SYSTEM OVERVIEW

Our Proposed Student Grievance Management System offers an organised way to address and manage student complaints in the school setting. Students will be able to submit, track

and manage their complaints through an online portal rather than manually processing their complaints, thus providing a central and database-driven process. In addition, grievance information will be stored in a relational database which will provide for effective management of grievances and readily access to the proposed data at any time. This technology will allow students to electronically submit grievances through an online portal. Each student's grievance record will have adequate data, student identification number, grievance type, grievance description, grievance severity level of issue and status of[]complaint. Not only will the system provide an accurate record of the resolution of each complaint, but it will provide administrators with a record-keeping mechanism for monitoring how many complaints they received based upon the organised data in the database.

Also, the system contains a simple automatic classification system. When a student submits a grievance, a keyword based search is conducted on the description of the grievance to determine what department is responsible for the grievance. The system will also assign a priority score based on the severity of the issue to each grievance at the same time. This technology will ensure that grievances will be properly referred to the appropriate department in a timely manner, without an manual classification process.

Another important feature of our grievance resolution process is the use of a hierarchical system to manage and resolve issues. Grievances will first be worked on at the department level and then moved up to the next higher level of authority if they are waiting and still unresolved after a specified time period. This will allow for grievances to be resolved quickly rather than taking a long time to get resolved. We have created an administrative dashboard within the grievance resolution system that contains all data related to grievance management (i.e. all unresolved grievances, rejected grievances, pending grievances).

IV. SYSTEM ARCHITECTURE

The architecture of the proposed Grievance Management System for Students consists of a structured manner of managing a student's grievances by including relational databases and application logic with a web interface. The four major parts of the architecture that make up the Grievance Management System for Students are as follows: The Grievance Categorization Module, A Database Management Layer, An Application Processing Layer, A User Interface Layer. All four components work together in a systematic manner for the grievance to be processed, archived, and tracked systemically throughout the entire grievance process.
The proposed system is illustrated in the diagram below, with students and administrators representing the first level of users. The users have access to the user interface layer for filing grievances, while the administrators have access to the user interface layer for managing and monitoring grievances. Application processing layer handles the following processes; automated escalation of unresolved grievances, keyword-based classification, grievance processing, and grievance authentication. The database layer is made up of the following relational tables: student table, administrator table, department table, grievance table and grievance log table, which store all data for the system (grievance management and monitoring). The tiered system design promotes organization of the system as a whole and can be used to support efficient grievance management and monitoring.

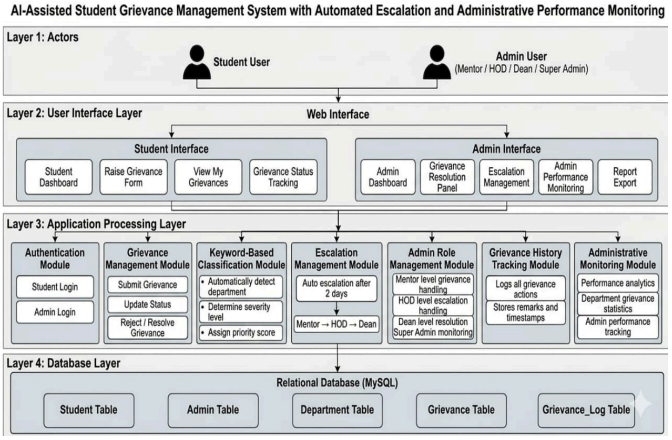

Figure 1: System Architecture of the AI-Assisted Student Grievance Management System.

The user interface layer is the first part of the architecture that provides administrators and students with a web-based application through which they can access and interact with the Grievance Management System for Students. Students can register, log in, and submit grievances in the Grievance Management System for the specific issue. In addition, students can access information on grievance status, review previously submitted grievances, and review the actions taken by the Grievance Management System for Students. Additionally, through the use of a different web-based portal, administrators are able to review and modify grievance status and monitor grievances via a dashboard application.

The second part of the architecture is the application processing layer, which is responsible for ensuring the integrity of the Grievance Management System for Student's core functionality. This layer is responsible for receiving and processing all user-initiated requests to the Grievance Management System, validating the input data, maintaining all grievance records within the Grievance Management System for Students and facilitating the flow of communication between the Grievance Management System for Students database and the User Interface layer. The application layer of the developed system is comprised of Python and a web framework that facilitates server-side processing and routing of requests.All administration tasks, grievances submitted and escalated, along with the authorization of users, are supported by the application logic of the system.

The grievance classification module is another significant part of the system's framework and it also provides the first level of automation for the system. When a student submits a grievance through the system, the system analyzes what is said in the grievance using a keyword detection approach. The system will apply the keyword detection method to determine the probable category of the grievance as well as

identify any terminology associated with departments. In addition to categorizing the grievance, the system will assess how urgent the grievance is and assign a priority score based on this assessment. By automatically categorizing grievances, the system will reduce the number of grievances that have to be routed by the administrator and will also help reduce the amount of work the administrator has to do.

The data access layer is the last layer of the architecture. It contains all system data and provides a means to store, manage, and access system data through the database management layer. There will be a relational database to store information related to departments, administrators, students, grievance records, and grievance report history. Each grievance record will include the student who reported the grievance, and the appropriate department for action, along with a unique identifier for each grievance record. Each grievance record will be organised in the relational format, with primary and foreign keys used to maintain integrity and allow for efficient access to associated records when using related records in the database by users. Database management standards can also produce statistical reports to provide information to the administrative dashboard. The overall design of the system is based on three tiers representing the user interface, application processing, and data storage. This design allows the system to automatically detect and escalate grievances in an efficient manner, provide for effective management of grievance records through the use of database management principles and procedures, and allow for effective system maintenance.

V. DATABASE DESIGN

The proposed Student Grievance Management System is composed primarily of how to design databases. The system will organize and maintain separate types of records such as departmental records, grievance-related records, student records and administrative records. One of the reasons, the relational database model was chosen is that it requires that all records in the database be organized in such a way that they can be accessed very quickly when needed, allowing a high degree of reliability and efficient access to information. In order to properly design the logical database structure we first needed to determine the major entities related to managing grievances and how they will relate to each other. These entities (departments, grievances, administration, students and grievance log) will make up the complete grievance management system. The relationships between the different entities will dictate how each component of the system will share information with one another. Creating the relationships is the first step in the overall process of using the relational database design in managing grievance records. The use of relational database design provides for the creation of relationship between the entities based on their roles in supporting the grievance management system, thus creating integrity in the database, as well as preventing data redundancy. Integrity is achieved through the relationship that is created between each entity by way of primary keys and foreign keys. Primary keys are identifiers that uniquely define an individual record in a particular table, and foreign keys are identifiers that create the relationships between two or more separate entities.
By ensuring these keys are maintained throughout the design of the system, we can ensure the data stored in the system remains consistent and organised.

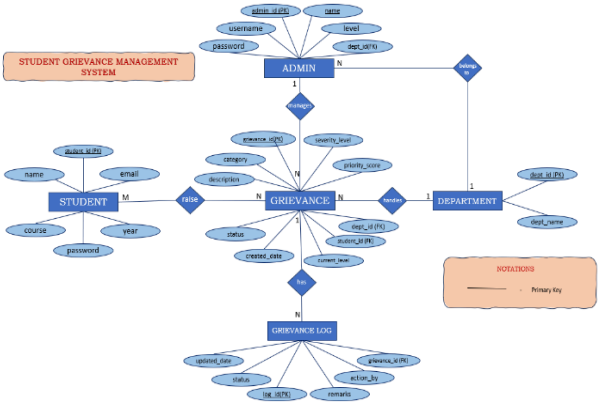

Figure 2: Entity Relationship Diagram of the Student Grievance Management System.

The above figure is the complete picture of the entities and their relationships that make up the grievance management system's database.

The Student entity stores all information about enrolled students, including their student number (ID), name, email address, programme of study (i.e. course), year of registration and password. The Student entity has a many-to-many relationship with the Grievance entity as there may be multiple grievances filed by a multiple student.

The Grievance entity holds all the information regarding student's grievances, including grievance number (ID), category, description of grievance, severity (i.e. urgency), priority score, current status, date created and level of resolution. Each grievance is linked with a student and the associated department.

The Department entity is used to store departmental information for each of the academic departments, hostels, examinations and libraries. Each department can manage multiple grievances filed against it.

The Admin entity holds all information about administrators, including admin number (ID), name, username, password, department number (ID) and administrator level. Throughout the grievance management process, administrators are responsible for overseeing and updating the status of grievances.

Grievances have an associated Grievance Log which keeps track of all the actions related to a grievance, including status changes, comments, and timestamps. Grievance logs improve the transparency of the grievance management system and allow for a full traceable history of grievance management.

Table Name	Description
Student	Stores student registration details
Admin	Stores administrator login and role details
Department	Contains department information
Grievance	Stores grievances submitted by students
Grievance_log	Stores history of grievance actions

Table 1: Database Tables Used in the Proposed System

Table 1 outlines the database tables that form the core data structures used in our system. Each table contains different types of data about students, administrators, departments, grievances and grievance history.This database design uses foreign key relationships between tables to make accessing grievance data easier and to keep the data consistent.

VI. METHODOLOGY

The proposed system's workflow outlines how grievances are received, categorised, and resolved in the system while helping to manage them more effectively through an organised database system and automated classification. The goal is to make grievance handling more efficient by using a single point of contact within the organization. When submitting a grievance through the online web portal, the grievance description will be the primary input for the classification process. To determine which department will resolve the grievance, the system will classify the grievance description based on keywords. The grievance description will be compared against a number of established keywords related to the following departments: academic, hostel, exam, transport, finance, and infrastructure. The grievance will then be automatically assigned to the designated department based on any identified keywords. The system will also assign each grievance a priority number and will rate the severity of the grievance as well. By using keywords that indicate a level of severity, the customer will be able to classify the grievance into one of three categories of severity: low, medium, and high. The priority number assigned to the grievance will allow administrators to quickly respond to more serious issues.

Once a grievance has been classified, it goes to the appropriate department administrator and is stored in the database. The administrator looks at the grievance and can either resolve it, deny it, or escalate it. A record of everything done related to the grievance is added to the grievance log table for record-keeping purposes. The system has an automatic escalation function to ensure that grievances are resolved quickly. If a grievance has not been resolved within a pre-defined time period, the system will automatically escalate the grievance to the next level of administration. This helps ensure that grievances are handled quickly.

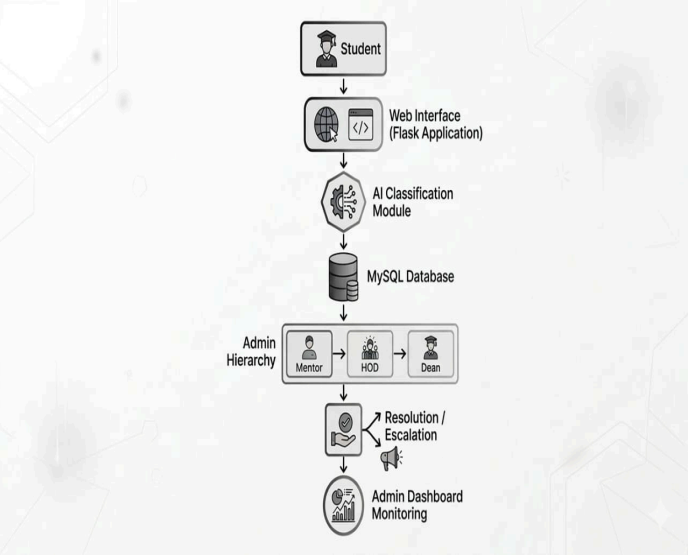

Figure 3: Workflow of the Proposed Student Grievance Management System.

The flowchart of the proposed grievance handling system can be seen in Figure 3. Students will open the web interface to submit their grievances. Once submitted, the grievance will be reviewed by the keyword classification module to classify the grievance into the appropriate department and assign a priority. The grievance data from the MySQL database will be submitted to the administrative hierarchy (i.e., Mentor, HOD, Dean). The administrator dashboard will help to monitor the entire process involved in resolving a grievance, and administrators will have the option to accept, deny, or escalate the grievance.

VII.IMPLEMENTATION

A proposed web-based solution for tracking complaints from students (as well as those from administrators) called "Student Grievance Management System" was created to make it simpler for both students and administrators to submit and resolve grievances against others. An easy-to-use web interface combined with a relational database provides storage, management and tracking of a grievance. MySQL is used for managing database information, HTML and Bootstrap are used for creating user interface webpages and Python is used for processing backend application code. Each of the Student Grievance Management System's component modules support a number of different users including super administrators, department administrators and students.

The Student Grievance Management System was designed so that all students can use their student interface to easily interact with their grievance. When a student has successfully logged into the Student Grievance Management System they will be presented with their student dashboard. At their student dashboard page, students will be

able to view their profile information, file new grievances and view previously filed grievances. The layout of the student dashboard provides students with quick and easy access to the various grievance functions available to them.

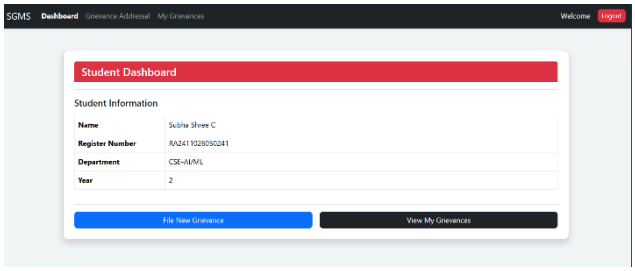

Figure 4: Student Dashboard Interface

The Grievance submission module makes it easy for students to submit complaints at the University. Students fill out a grievance submission form by selecting a category of grievance and providing a detailed explanation of the problem. The grievance submission module has an automated functionality in which it runs a keyword-based detection analysis against the grievance description when a student submits a grievance. This will then return a determination of the relevant department and appropriate priority of the grievance based off of the keywords found in the grievance description. By automating this task, student complaints are sent to the appropriate department in a timely manner and there is a reduction in the administrative workload of manually categorizing/grading student complaints.

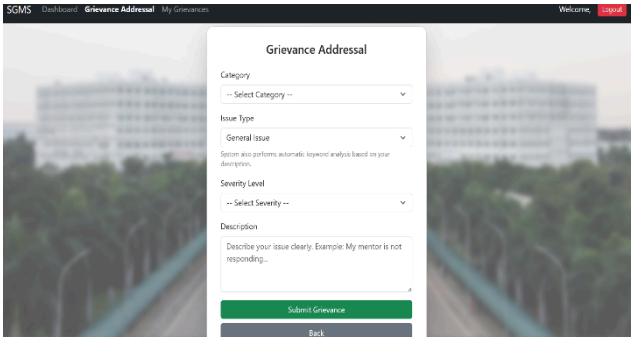

Figure 5: Grievance Addressal form

The administrative module enables department administrators to manage grievances assigned to their department. After logging into the system, administrators can see the grievance details such as grievance category, severity level, priority of grievance, and grievance status on the administrator dashboard. Administrators have the ability to reject an improper grievance complaint or resolve the grievance complaint. All actions performed by the administrator are documented in the grievance log table which captures all of the activities/timelines related to each grievance incident and provides a basis for maintaining the integrity of the grievance management process.

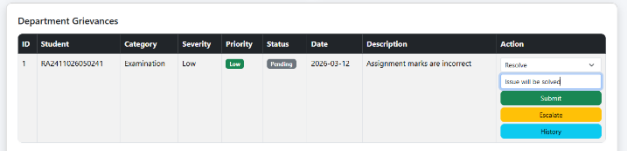

Figure 6: Administrative Dashboard For Grievance Resolution.

The above module implementations are examples of how basic automation techniques and database management principles can be combined to create a functional and efficient grievance management system for educational institutions.

VIII.RESULTS AND DISCUSSION

To test the efficiency of the proposed system's grievance submission, classification, escalation and monitoring processes, multiple test scenarios were conducted to determine that these processes works as expected. As part of the testing process, a number of different grievances (with varying degrees of complexity) were submitted through the grievance process, and their progress through each level of the grievance handling process was monitored.

Test Case ID	Module Tested	Input	Expected Output	Result
TC1	Student Registration	Valid student data	Account created	Pass
TC2	Student Login	Correct credentials	Dashboard displayed	Pass
TC3	Grievance Submission	Hostel water issue	Complaint stored in DB	Pass
TC4	Department Detection	Bus route problem	Transport department detected	Pass
TC5	Auto Escalation	Grievance pending>2 days	Escalated to next level	Pass

Table 2: Functional Test Case Validation Results

The results show that all modules of the system operate correctly and that all complaints are processed correctly through the workflow of the system.

Another major feature of the system is the automatic detection of departments and assignment of priority levels to grievances or complaints submitted by students through the use of the algorithm. This allows administrators to assess and prioritise high priority complaints without having to search through many complaints to find out who is responsible for them.

Grievance Description	Detected Department	Severity	Priority Score
Hostel water supply issue	Hostel	Medium	2
Marks wrongly entered in exam portal	Examination	High	3
Bus not stopping at my stop	Transport	Medium	2
Fee payment error in portal	Finance	High	3

Table 3: Automatic Department Detection and Priority Assignment

The grievance tracing feature enables students to follow their grievance through each stage until it is resolved. Any grievance that is not resolved within the time limit will automatically be referred to the next level of administration. This enables the continual tracing of unresolved grievances and ensures that they do not remain unresolved for long periods.

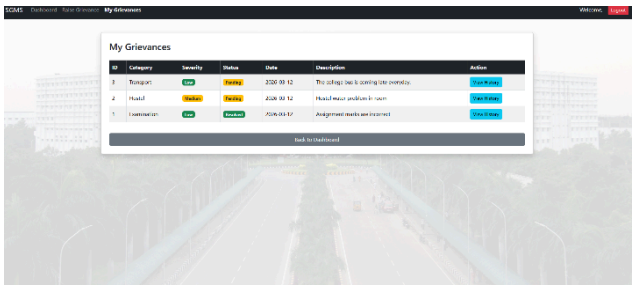

Figure 6: Student Grievance Tracking with Automatic Escalation

Another key result of the implementation is the monitoring tool for super administrators. Statistics about grievances, including those that are pending, resolved, denied and in-progress are provided on the administrative monitoring dashboard. In addition to displaying graphs and charts, the monitoring dashboard allows super administrators to export the report as a Portable Document Format (PDF) file. These tools enable institutional administrators to evaluate the effectiveness of grievance resolution procedures at the institution as well as to analyse patterns of grievances.

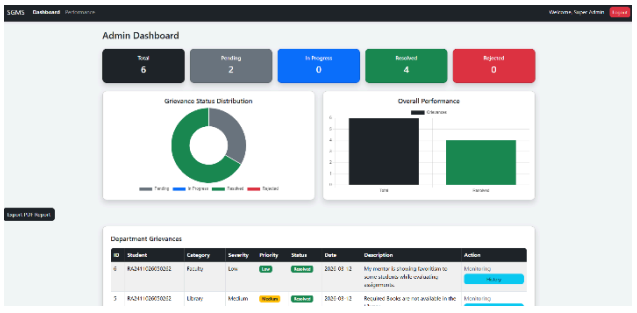

Figure 7: Super Administrator Monitoring Dashboard with Analytics

The results of the study demonstrate that the proposed system improves both the efficiency and the transparency of the grievance management process. The system combines straightforward, automated methods with relational database design to provide an integrated approach for managing student complaints in institutions of higher education.

IX.CONCLUSION

Our project's primary goal is to establish a structured system for receiving, processing and monitoring student complaints in educational institutions. At present , a great deal of grievance management at educational institutions occurs informally or manually, resulting in delays, inadequate tracking and low levels of transparency. In order to solve these issues, our research proposed " Student Grievance Management System" that uses basic forms of automation, such as keyword-based classification of grievances and automatic escalation of grievances, as well as database-management concepts. The entire array of grievance data is stored in a centralized relational database that includes appropriate keys and correctly structured tables to ensure data integrity and facilitate the efficient retrieval of data. In addition, there is a web-based platform where students can submit grievances and monitor progress. The automatic classification of grievances to identify the appropriate department and priority provides for expedited routing of the grievance to the appropriate department with a minimum amount of human intervention. Complaints may also be resolved in a timely manner because of the automatic escalation of complaints and the hierarchical resolution of complaints. Furthermore, the administrative dashboard, through monitoring the number of complaints and evaluating the performance of the administration, increases the accountability and transparency of the administration.This current plan illustrates that the integration of a database system combined with basic automated functionality could improve the handling of grievances within educational institutions. Since, this system uses only rule-based keyword recognition to understand complex definitions of complaints it may lack comprehensiveness due to its dependance on rules and keywords alone. Future enhancements of our system is to integrate more advanced natural language processing techniques, mobile applications for easier access by students, and analytical tools to assess data trends of grievance statistics to enhance an institution's overall ability to make transparent decisions regarding complaints.

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