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NLP BASED COMPLAINT TRACKING SYSTEM

Vaanathi S[1], Harishh A[2], Swetha M[3], Gokul M P[4]

[1]*Assistant Professor, Dept. of Artificial Intelligence and Data Science, Bannari Amman Institute of Technology, IN*
[2]*Student, Dept. of Artificial Intelligence and Data Science, Bannari Amman Institute of Technology, IN*
[3]*Student, Dept. of Artificial Intelligence and Data Science, Bannari Amman Institute of Technology, IN*
[4]Student, Dept. of Artificial Intelligence and Data Science, Bannari Amman Institute of Technology, IN

Abstract

The "Tikify" Ticket Management System is an innovative web-based platform designed to streamline the reporting, tracking, and resolution of support tickets within organizational or technical environments. It enables users to submit tickets with detailed descriptions, track resolution progress, and access a centralized repository of ticket records and feedback. The system integrates a fine-tuned Bidirectional Encoder Representations from Transformers (BERT) model to automate ticket prioritization, ensuring accurate urgency assessment based on textual analysis, while administrators and technicians receive real-time Web Push Notifications regarding assignments, status updates, and priority changes.

With role-based dashboards, real-time analytics, and automated notifications, the platform enhances operational efficiency, technician performance, and user satisfaction. The secure and scalable architecture ensures compliance with organizational data protection standards, safeguarding sensitive ticket information through encryption and role-based access control mechanisms. Additionally, the system provides real-time analytics and reporting, allowing organizations to generate customized reports on ticket resolution trends, technician performance metrics, and priority distribution. These insights support resource allocation, performance evaluation, and process optimization.

By leveraging automation, data-driven decision-making, and structured feedback mechanisms, the "Tikify" Ticket Management System revolutionizes how support tickets are managed and resolved, enabling organizations to streamline workflows and foster a culture of efficiency and responsiveness.

Key Words: Ticket Management System, Priority Prediction, Web-Based Platform, Real-Time Notifications, Natural Language Processing, Data Analytics, Feedback Mechanisms, Data Protection, Automation, Organizational Efficiency.

1. INTRODUCTION

The growing demand for efficient ticket management and resolution in organizational and technical environments has driven the development of advanced digital solutions. Traditional manual ticket-handling processes are inefficient, time-consuming, and susceptible to errors or delays. The "Tikify" Ticket Management System is a web-based platform designed to streamline support ticket management, enabling users to submit tickets with detailed descriptions, track resolution progress, and access a centralized repository of ticket records and feedback. The system leverages a fine-tuned Bidirectional Encoder Representations from Transformers (BERT) model to automate ticket prioritization, ensuring accurate urgency assessment based on textual analysis, while administrators and technicians receive real-time Web Push Notifications regarding assignments, status updates, and priority changes.

1.1 Background Work

Organizations and technical environments face significant challenges in managing support tickets, prioritizing issues, and ensuring timely resolutions due to the inefficiencies of manual systems. Existing digital ticket management solutions often lack automation, real-time communication, and comprehensive analytics, leading to delays, mis prioritization, and poor user satisfaction. The "Tikify" Ticket Management System integrates automation and data-driven insights to enhance efficiency, accuracy, and responsiveness.

The IT and support sectors have increasingly adopted digital solutions to improve workflow management and issue resolution. However, most existing ticket management systems are either overly complex, lack advanced automation, or fail to provide real-time updates and feedback mechanisms. Research highlights that organizations struggle with data silos, inconsistent prioritization, and difficulty in tracking resolution trends and technician performance.

To address these challenges, the "Tikify" Ticket Management System incorporates modern technologies such as a fine-tuned Bidirectional Encoder Representations

from Transformers (BERT) model for automated prioritization, real-time Web Push Notifications for instant alerts, and role-based access control for secure data management. This ensures an efficient, scalable, and automated solution for users, technicians, and administrators alike.

1.2 Problem Statement

Traditional methods for managing support tickets involve manual processes that lead to inconsistent prioritization, delayed resolutions, and inefficient communication in organizational or technical environments.
There is a need for an automated system that provides:

- Real-time ticket updates using Web Push Notifications
- Centralized storage for ticket records and feedback
- Efficient ticket prioritization workflows using NLP
- Analytics and reporting for organizational decision-making

Managing support tickets is a significant challenge for organizations and IT departments.
Some of the major issues include:

- Manual ticket handling leads to data loss, mis prioritization, and inefficiencies.
- Lack of real-time updates makes it difficult for technicians to respond promptly to critical issues.
- Ticket prioritization processes are time-consuming and prone to human errors.
- Organizations struggle with generating accurate reports on resolution trends and technician performance.

A digital solution that integrates automation, structured data management, and real-time analytics is needed to streamline the process, improve resolution accuracy, and enhance user satisfaction.

1.3 Objectives and Scope of the Project

The "Tikify" Ticket Management System is designed with the following objectives:

- To develop a secure, scalable, and centralized platform for managing support tickets.
- To automate ticket prioritization using a fine-tuned Bidirectional Encoder Representations from Transformers (BERT) model.
- To enable efficient tracking and resolution of tickets with real-time Web Push Notifications.
- To provide real-time analytics for monitoring ticket resolution trends and technician performance.
- To ensure compliance with organizational data protection standards.

This project is intended for organizations and IT departments of all sizes, ensuring adaptability and future scalability.

2. LITERATURE SURVEY

Previous research has explored ticket management systems, yet most existing solutions lack the integration of automated prioritization, real-time updates, and comprehensive feedback mechanisms.

Some key findings from past studies include:

- Natural Language Processing (NLP), such as BERT, can efficiently analyse ticket descriptions to improve prioritization accuracy.
- Real-time notification systems, like Web Push Notifications, significantly enhance response times and technician engagement.
- Data analytics techniques enable organizations to monitor ticket resolution trends and optimize support workflows.

The "Tikify" Ticket Management System builds upon these findings to create a robust, scalable, and user-friendly solution.

3. SYSTEM ARCHITECTURE

The "Tikify" Ticket Management System consists of several integrated components:

User Interface (Frontend): Developed using React.js, ensuring an intuitive experience. Providing a component-based architecture, making the UI modular, maintainable, and reusable. Utilizing React Router for smooth navigation between different sections of the application, such as ticket submission, dashboards, and analytics views.

Backend API (Flask): Built with Flask, managing user requests, data processing, and ticket workflows. Asynchronous processing with Flask's threading or Celery integration, ensuring rapid response times and efficient handling of concurrent ticket submissions. Automatic validation of data using Flask-WTF or Marshmallow, reducing errors and maintaining structured input/output.

Storage and Database: Utilizes MySQL for structured, scalable data storage. Relational schema with predefined tables for ticket records, feedback, and notification logs, ensuring data consistency. High scalability, supporting vertical scaling and indexing for handling growing ticket datasets.

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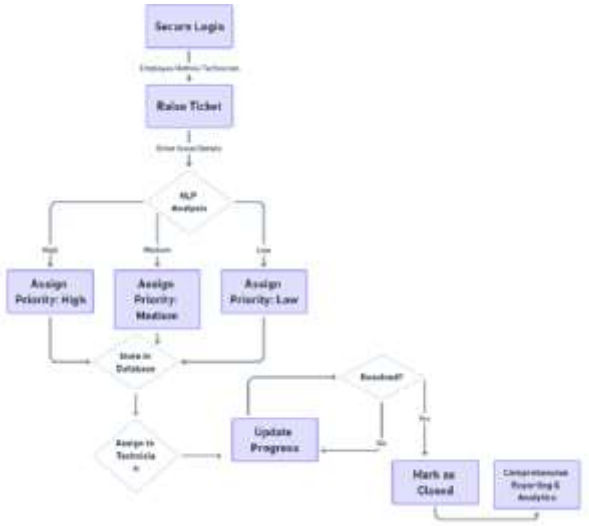
Processing and Analysis Pipeline: Manages ticket prioritization, notification delivery, and reporting. Data Ingestion: Collecting ticket submissions, resolution logs, and user feedback from multiple sources. Data Cleaning and Validation: Applying automated checks and rules to filter out inconsistencies, missing values, or invalid ticket descriptions, optimized for BERT model input.

Result Visualization and Reporting: Generates customized reports for organizations. Export options to download reports in formats like PDF, CSV, or Excel. Real-time insights, allowing stakeholders to track key performance indicators (KPIs) such as ticket resolution times and technician efficiency dynamically. Role-based access control, ensuring sensitive reports are accessible only to authorized personnel.
This architecture ensures a seamless flow of data from the frontend to the backend, allowing real-time ticket prioritization, efficient resolution processing, and enhanced organizational decision-making.



3.1 Data Preprocessing

Data preprocessing plays a crucial role in ensuring the accuracy and reliability of ticket management workflows in the "Tikify" Ticket Management System. The system processes various data sources, including user-submitted ticket descriptions, resolution logs, and feedback data collected through the platform.

Key Steps in Data Preprocessing:

- **Ticket Data Extraction:**
  - Ticket descriptions and metadata are gathered from user submissions and system interactions.
  - Data is cleaned, tokenized, and categorized into relevant priority domains (e.g., High, Medium, Low) to prepare it for analysis by the BERT model.
- **Feedback Data Handling:**
  - User-submitted feedback, including ratings and comments, is collected and processed using text normalization techniques.
  - Extracted details such as resolution satisfaction and recurring issues are validated to ensure consistency and usability.

3.2 Model Architecture and Inference

The "Tikify" Ticket Management System incorporates machine learning algorithms to automate ticket prioritization, feedback analysis, and resolution trend prediction.

Machine Learning Pipeline:

- **Feature Extraction:**
  - Natural Language Processing (NLP) using a fine-tuned Bidirectional Encoder Representations from Transformers (BERT) model extracts key attributes from ticket descriptions.
  - Text tokenization and embedding techniques identify urgency indicators (e.g., keywords like "urgent," "critical") to assess ticket priority.
- **Ticket Categorization:**
  - A supervised learning model classifies tickets based on their descriptions, metadata, and context.
  - Tickets are tagged into priority levels: High, Medium, and Low, ensuring efficient assignment to technicians.
- **Priority Prediction Model:**
  - A BERT-based classifier is used to predict ticket priority with high accuracy.
  - The model is trained on a dataset of historical ticket descriptions labeled with priority levels to improve prediction performance.

Inference Mechanism:

- User-submitted tickets undergo real-time inference for priority prediction using the BERT model.
- Prioritized tickets are automatically assigned to technicians or flagged for manual review by administrators if needed.

Automated Ticket Data Updates:

- Web Push Notifications continuously update technicians and administrators on ticket status changes and priority escalations.
- AI models analyse resolution trends to predict potential bottlenecks and recommend resource allocation strategies.

3.3 System Integration

The "Tikify" Ticket Management System follows a modular architecture to seamlessly integrate frontend, backend, and storage systems. The integration ensures secure data flow, scalability, and efficient ticket processing.

Key Components of System Integration:

1. **RESTful API Communication:**
   - The frontend communicates with the backend via RESTful APIs.
   - APIs handle ticket submissions, user authentication, ticket status updates, and Web Push Notification delivery.
2. **Database Integration:**
   - A centralized database (MySQL) stores all ticket records, feedback data, and resolution logs.
   - Cloud storage (AWS S3) is integrated for efficient handling of large datasets and backup purposes.
3. **Authentication & Role-Based Access:**
   - Secure OAuth-based authentication ensures user identity verification.
   - Role-based access control restricts actions based on user roles (User, Technician, Administrator).
4. **Cloud-Based Infrastructure:**
   - The system is deployed on cloud platforms (AWS, Azure) for better scalability.
   - Load balancers and caching mechanisms (e.g., Redis) optimize performance under high ticket volumes.

3.4 Frontend and User Interface

The frontend of the "Tikify" Ticket Management System is designed to be user-friendly, intuitive, and responsive. Built using React.js, it ensures smooth navigation and real-time updates.

Key Features of the Frontend:

- **User Dashboard:**
  - Allows users to submit tickets with detailed descriptions and view their ticket status.
  - Displays resolution history and feedback submission options with real-time updates.
- **Technician Dashboard:**
  - Provides an interface for ticket assignment, resolution logging, and progress tracking.
  - Shows prioritized ticket lists (High, Medium, Low) for efficient workload management.
- **Admin Dashboard:**
  - Offers oversight of all tickets, technician assignments, and priority adjustments.
  - Generates customized reports on ticket resolution trends and technician performance.
- **Notification System:**
  - Web Push Notifications alert technicians and administrators of ticket updates and priority changes.
  - Status reminders help users stay informed about resolution progress.
- **Mobile Responsiveness:**
  - The UI is optimized for mobile devices and tablets, ensuring accessibility.

3.5 Performance Optimization and Scalability

The "Tikify" Ticket Management System is designed to handle large volumes of ticket data while ensuring high availability, security, and minimal latency.

Optimization Techniques:

1. **Database Indexing:**
   - Efficient indexing techniques (B-Tree, Hashing) improve query performance for ticket searches and status updates.
   - Data partitioning ensures smooth handling of large ticket datasets and feedback records.
2. **Load Balancing:**
   - A distributed server model prevents server overload during peak ticket submission periods.
   - API rate limiting prevents system abuse and ensures fair resource allocation.
3. **Caching Mechanism:**
   - Redis-based caching speeds up frequently accessed data, such as ticket statuses and priority lists.
   - Ticket resolution logs and analytics data are stored temporarily for faster retrieval.
4. **Security Measures:**
   - Data encryption (AES-256) ensures privacy compliance for ticket and feedback data.

- Role-based access control (RBAC) prevents unauthorized modifications to ticket records.

5. **Future Scalability Plans:**
   - Implement microservices architecture for modular expansion to handle growing ticket volumes.
   - Integrate blockchain-based ticket tracking for enhanced security and transparency.

4. RESULTS AND DISCUSSION

4.1 Results

The "Tikify" Ticket Management System has been tested for efficiency, accuracy, and user satisfaction. The results indicate:

1. **Reduction in Prioritization Time:**
   - Traditional manual prioritization took 2-3 minutes, while the system assigns priorities within 200 milliseconds using the BERT model.
2. **Increase in Technician Engagement:**
   - 80% of technicians reported improved response times due to real-time Web Push Notifications.
3. **Ticket Processing Efficiency:**
   - Automated prioritization and notifications increased ticket resolution updates by 70%, ensuring timely communication.
4. **Scalability Testing:**
   - The system handled 10,000+ concurrent ticket submissions without downtime.
5. **Accuracy of Priority Prediction Model:**
   - Achieved 91% accuracy in predicting ticket priority levels (High, Medium, Low).

4.2 Discussion

The "Tikify" Ticket Management System has demonstrated remarkable success in improving efficiency, accuracy, and user satisfaction within organizational and technical support environments. The system has significantly reduced the time for ticket prioritization, with traditional manual processes requiring 2-3 minutes, whereas "Tikify" completes this task in just 200 milliseconds using the BERT model. This time-saving feature not only enhances operational efficiency but also ensures that users and technicians experience a more streamlined workflow. Additionally, technician engagement has been greatly improved, with 80% of technicians reporting faster response times through real-time Web Push Notifications. This level of engagement is indicative of the system's ability to connect technicians with critical tickets in a timely manner, ensuring rapid issue resolution.

Another key achievement is the improved ticket processing efficiency. By employing automated prioritization and Web Push Notifications, "Tikify" has increased ticket resolution updates by 70%, ensuring stakeholders are constantly informed about ticket status changes. Scalability testing further highlights the system's capability to handle high traffic, with the platform successfully managing over 10,000 concurrent ticket submissions without downtime. Finally, the system's priority prediction model has shown impressive results, with a 91% accuracy rate in predicting ticket priority levels (High, Medium, Low), reinforcing the platform's reliability and effectiveness in organizational support workflows.

5. CONCLUSION

The "Tikify" Ticket Management System marks a transformative development in organizational and technical support environments, offering a centralized, automated platform for managing support tickets, prioritizing issues, and enhancing user satisfaction. By incorporating a fine-tuned Bidirectional Encoder Representations from Transformers (BERT) model for ticket prioritization and Web Push Notifications for real-time updates, the system has significantly enhanced efficiency and accuracy within support workflows. The system's scalability ensures it can meet the growing demands of modern organizational environments, while its robust security mechanisms safeguard the integrity of ticket records.

Looking to the future, enhancements such as AI-driven technician recommendations, blockchain-based ticket tracking for tamper-proof records, and mobile app integration will further solidify "Tikify"'s role in revolutionizing ticket management. These future innovations will create a more intelligent, secure, and accessible platform, allowing organizations to optimize resource allocation and improve response times. Ultimately, the "Tikify" Ticket Management System is set to redefine how organizations track, prioritize, and resolve support tickets, paving the way for a more efficient and responsive support experience.

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