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QR-Based Smart Public Service Feedback and Priority Management System

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Abstract: ***The AI-based QR code system for public service feedback and priority management aims to improve public grievance redressal operations through better efficiency and transparency and enhanced public service responsiveness. The system enables citizens to submit complaints through text and images by scanning QR codes that public service locations display. The system automatically captures essential metadata such as location ID, department ID, and timestamp to ensure accurate tracking and management. The system uses machine learning techniques to process and classify complaints through Term Frequency–Inverse Document Frequency (TF-IDF) text feature extraction and Logistic Regression complaint classification.***
The system uses Random Forest algorithm for detecting priority levels and it employs MobileNetV2 for validating images to achieve precise analysis results. The system uses these techniques to classify complaints into different categories which receive corresponding priority designations. The system sends urgent alerts to relevant departments when high-priority complaints occur, while it automatically forwards unresolved cases to higher authorities for prompt resolution. The real-time dashboard presents analytical data that includes total complaints and pending cases along with resolution time, which enhances monitoring capabilities and aids in decision-making processes. The proposed system demonstrates improved response time, enhanced accountability, and increased citizen satisfaction, making it a scalable solution for smart city and e-governance applications.
Index Terms: QR Code, Smart City, Public Service Feedback, Complaint Management System, Machine Learning, TF-IDF, Random Forest, MobileNetV2, Real-Time Tracking, E-Governance.

I. INTRODUCTION

The QR-Based Smart Public Service Feedback and Priority Management System is an advanced solution aimed at improving the efficiency, transparency, and responsiveness of public service management in smart cities. In many regions, citizens face daily issues such as water leakage, improper waste disposal, streetlight failures, road damage, and drainage problems. However, traditional complaint systems are often manual, time-consuming, and lack proper monitoring, resulting in delayed responses and reduced citizen satisfaction.

This system introduces the use of QR codes placed at strategic public locations like streets, bus stops, government offices, hospitals, and residential areas. Citizens can simply scan the QR code using their smartphones to access a complaint submission interface. They can provide details through text, images as input, making the system accessible and user-friendly. The system automatically captures important data such as location ID, department ID, and timestamp, ensuring accurate and reliable complaint registration without manual intervention.

A key feature of the system is intelligent complaint classification and priority management. Complaints are automatically categorized into departments such as water supply, electricity, sanitation, road maintenance, and public safety. Based on the nature and urgency of the issue, the system assigns priority levels like High, Medium, or Low. High-priority complaints, such as emergency situations or safety hazards, are immediately forwarded to the concerned authorities with instant alerts, while lower-priority issues are handled systematically. The system also provides real-time tracking and status updates, allowing citizens to monitor the progress of their complaints. This increases transparency and builds trust between the public and government authorities. Additionally, a centralized administrative dashboard is provided for officials to view all complaints, track pending and resolved cases, analyse performance, and manage resources efficiently. The system can also include escalation mechanisms, where unresolved complaints are automatically forwarded to higher authorities after a certain time.

By integrating QR technology with smart data processing and priority management, this project reduces manual workload, speeds up issue resolution, and ensures accountability in public services. It helps create a more responsive governance system, improves citizen engagement, and contributes to the development of smart and sustainable cities.

Objective	Metric	Outcome
O1	Complaint Registration Time	Faster complaint submission through QR scanning
O2	Classification Accuracy	Correct assignments to departments (water, sanitation, electricity, etc.)
O3	Priority Detection Efficiency	Effective identification of high-priority issues
O4	System Usability	Real-time tracking and easy-to-use web interface

Table 1: Objective Mapping

II. LITERATURE SURVEY

Digital systems enable citizens to report issues through automated platforms which people consider a major enhancement for public service management according to widespread recommendations. The initial systems operated through manual methods which included using phone calls and paper forms and visiting offices to register complaints. Complaints which followed traditional methods suffered from three main problems which included delays and lack of transparency and poor complaint tracking. The introduction of basic e-governance systems enabled citizens to submit complaints through web portals to solve these three main problems. These systems required users to wait for tracking updates because they did not have tracking systems which showed progress in real time and used smart systems to determine which tasks were more important to complete [1].

Researchers have studied how mobile applications could improve public grievance systems. The applications enabled users to report complaints together with photographs and their current location which made reporting issues more precise. The system integrated GPS and cloud storage technologies to improve both data accessibility and management capabilities. The systems needed manual sorting to process complaints which created efficiency problems during times of high request volume despite the new features which were added [2].

Machine learning progress enabled researchers to create intelligent systems which could automatically classify customer complaints. The system used Support Vector Machines Decision Trees and Naïve Bayes algorithms to assign complaints to different departments which handled water and electricity and sanitation and road-related issues. The models enabled complete automation of the routing process which decreased the need for human contact while enhancing the speed of response. The systems needed structured data input, but they could not handle unstructured data which included text and voice complaints [3].

III. PROPOSED METHODOLOGY

A. System Overview

The QR-Based Smart Public Service Feedback and Priority Management System was developed with a modular architectural design which allows for expandable public complaint processing and interdepartmental government operations. The system operates through three architectural components which include the presentation layer and application logic layer and data layer. The system functions through a central server which operates as an API layer to control data movement and execute user actions while linking different system components.

The presentation layer provides a user-friendly interface where citizens can easily submit complaints by scanning QR codes placed at public locations such as streets and offices and hospitals and transport areas. The application layer processes input data through intelligent algorithms which classify and prioritize the data before dispatching the complaint to the correct department. The data layer stores all complaint records, user inputs, and system logs securely for future analysis and tracking.

The system divides its operations into distinct functional modules which handle specific tasks throughout the complaint management system.

These modules work together to ensure efficient and real-time grievance handling. The main components of the system include:

- QR Code-Based Complaint Registration
- Data Collection Module
- Data Processing and Cleaning Module
- Complaint Classification Module
- Priority Management Module
- Department Routing Module
- Real-Time Tracking and Notification Module
- Database Management System

This modular design allows each component of the system to be independently updated or enhanced without affecting the overall functionality. It also ensures scalability, enabling the system to handle a large number of complaints efficiently in a smart city environment.

B. Ai Architecture And Intelligent System Integration

The system architecture integrates intelligent algorithms to analyse citizen complaints and automate classification, prioritization, and routing processes. Instead of deep learning on molecular data, this system uses Artificial Intelligence and Natural Language Processing (NLP) techniques to understand user-submitted complaints and identify their category and urgency.

Some key features for integration are:

- REST-based API Communication: Ensures smooth interaction between frontend interfaces, backend services, and AI modules for real-time processing.
- On-the-fly Data Processing: Complaint data (text, images, location) is processed instantly after submission.
- Machine Learning Model Integration: Models built using tools like Python, Scikit-learn, or TensorFlow are used for classification and priority prediction.
- Handling Unstructured Data: The system efficiently processes text inputs, voice (optional), and images for better understanding of complaints.

The AI-based model is trained on historical complaint datasets and can automatically detect complaint categories and assign priority levels based on patterns and keywords, improving efficiency over manual systems.

C. Complaint Processing Workflow

The system follows a multi-stage workflow for handling public complaints efficiently:

- The user scans a QR code placed at a public location and opens the complaint submission interface.
- The user enters complaint details such as description, optional image, and selects or confirms the service category.
- The system automatically captures metadata such as location ID, timestamp, and department ID.
- The complaint text is processed using NLP techniques to extract meaningful information.
- The processed data is sent to the AI model to determine the category and urgency level.
- The complaint is then forwarded to the respective department for resolution.

D. Data Processing and Feature Extraction Engine

The data processing module plays a crucial role in preparing complaint data for intelligent analysis. This module performs:

- Text Analysis: Extracts keywords and important phrases from user complaints using NLP techniques.
- Data Cleaning: Removes irrelevant or duplicate data to improve accuracy.
- Feature Extraction: Converts complaint text into numerical representations (such as TF-IDF or word embeddings) for machine learning models.
- Image Handling: If images are provided, basic image validation or classification can be applied.

These features help the AI model understand the nature of complaints and improve classification and prioritization accuracy.

E. Complaint Classification And Priority Prediction Engine

This system's central mechanism for intelligent analysis of complaints and for making informed decisions is the last stage:

- Model Inference: Extracted features are provided as input to the trained machine learning model.

- Complaint Classification: The system categorizes complaints into departments such as water, electricity, sanitation, roads, or public safety.
- Priority Assignment: Complaints are labeled as High, Medium, or Low priority based on urgency, keywords, and severity.
- Pattern Learning: The AI model continuously improves by learning from historical complaint data and resolution patterns.

The system is capable of not only handling known complaint types but also adapting to new and unseen issues.

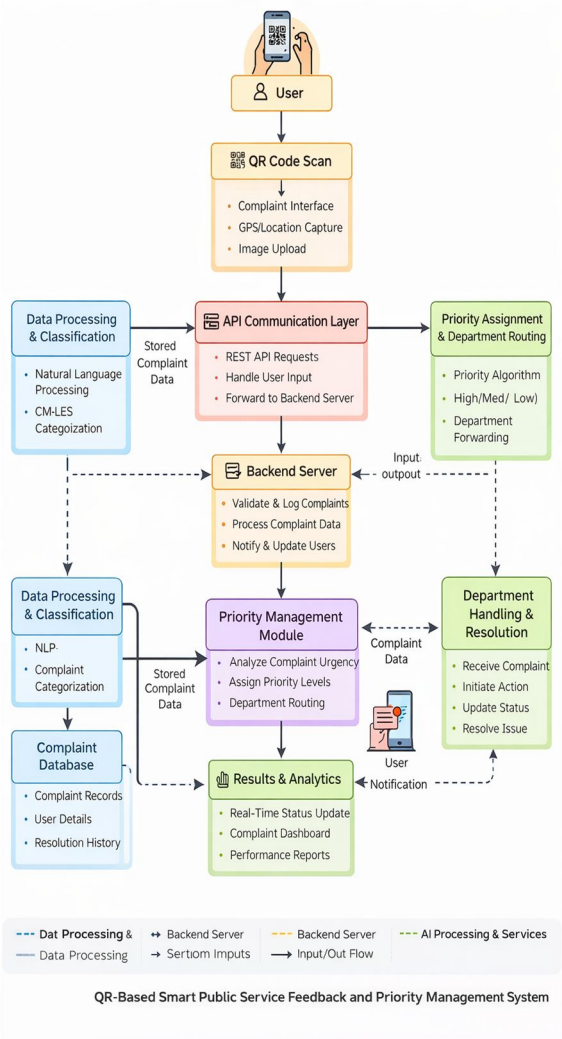

Fig. 1. System Architecture

F. Security And Data Protection

Security measures are integrated into the system to guarantee a high data quality and safe user-characteristic manipulation.

- Data Encryption: All user data and complaints undergo encryption, and storage will be ensured according to the requirement.
- Authentication and Authorization: Secure login mechanisms for administrators and department officials.
- API Security: The system uses secure protocols to protect communication between its frontend and backend components.
- Data Privacy: User information remains protected against unauthorized use while the system operates according to fundamental data protection standards. secured by means of authentication methods.

G. Performance Requirements

The system is built to deliver quick and dependable performance which can expand to meet growing demands. The system performance tests base their evaluation of success on these two main metrics:

- The system is built to deliver quick and dependable performance which can expand to meet growing demands. The system performance tests base their evaluation of success on these two main metrics:

- Response Time: Users should be able to submit complaints and complete processing within a few seconds.
- System Availability: The system needs to operate at high uptime levels while delivering reliable service throughout all operational periods.
- Scalability: The system needs to support multiple users who can lodge complaints at the same time.
- Processing Efficiency: The system manages extensive data sets while it processes active complaint classification in real time.

IV. IMPLEMENTATION

A. *System Architecture*

The system uses a client-server architecture which connects its web-based frontend to its Python-based backend for the QR-Based Smart Public Service Feedback and Priority Management System. The system uses a modular design which divides its function to separate layers that help the system grow and adapt while maintaining its ability to handle user complaints.

The system has three main layers which provide its essential functions.

- User Interaction Layer: This layer provides the interface for users to scan QR codes and submit complaints easily through their mobile devices or web browsers.
- Application/Processing Layer: The system uses intelligent algorithms to handle validation of complaints and processing of data and classification of information and determination of priority levels.
- AI/Machine Learning Layer: The system uses natural language processing methods to analyze complaint text which results in the assignment of category and priority level to the text.
- Database Layer: The system securely stores all complaint records which include user inputs and department details and resolution history.

The system lets users update individual components like AI models and APIs and databases without causing any disruptions to the rest of the system.

B. *Front-End Implementation*

The system uses REACT together with JavaScript to create a frontend which enables citizens to access its basic functions.

The frontend includes the following essential features:

- Home Page: The home page introduces the system and allows users to submit complaints through its interface.
- QR Code Interface: The system provides users with the ability to scan QR codes located in public areas which will directly take them to the complaint form.
- Complaint Submission Form: Users can enter complaint details, upload images (optional), and submit issues through the form which allows them to report complaints with ease.
- Dashboard/Status Page: The dashboard shows users their complaint progress through status updates and their complete complaint history.
- Visualization Section: The section presents statistical data which includes both complaint patterns and the current state of case resolutions.

The frontend uses REST API calls to connect with the backend system which enables them to exchange data in real time. The system uses input validation to prevent users from submitting incomplete or incorrect information.

C. *Backend Implementation*

The backend development team builds the system through Python programming with FastAPI or Flask framework to create restful services which process user requests and handle complaint information.

The system functions through three essential backend components which include

- Complaint Management Module: Handles creation, storage, and retrieval of complaints.
- API Services: Manages communication between frontend and backend.
- Authentication Module: Ensure secure access for administrators and department officials.
- Notification Module: Send updates to users regarding complaint status.

The backend system handles requests efficiently while managing data processing and maintaining seamless connections with artificial intelligence components.

D. Data Processing and Feature Extraction Module

The module handles the processing work of complaint data to create an intelligent analysis-ready dataset.

Functions include:

- Text Processing: The system uses NLP techniques to extract important keywords from complaints.
- Data Cleaning: The process removes all types of unwanted data including duplicate entries and irrelevant information.
- Feature Extraction: The system transforms text content into numerical data using formats such as TF-IDF and embeddings which serve as model input.
- Image Processing: The system checks and processes user-uploaded images to enhance the understanding of their problems.

The module provides precise and effective data entry for the classification system and priority system.

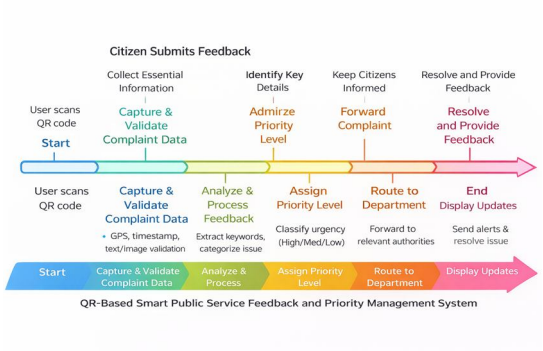

Fig. 2. Smart feedback Process Workflow

E. Data Processing Pipeline

The system uses a structured pipeline for handling complaint data:

Complaint Workflow: Users submit complaints by scanning QR codes. The system records user input information together with location data and timestamp data. The process involves cleaning and developing the data. The system assigns the complaint to the appropriate department based on its content. The system assigns a priority level which can be either High or Medium or Low. The department receives the complaint which needs to be processed. The system provides the user with progress reports about their request.

Model Training Workflow: The system collects all historical complaint records. The process involves cleaning and assigning labels to the data. The system extracts feature from the text of complaints. The development team creates machine learning models which perform two functions: they classify and they assign priority level. The evaluation uses accuracy and precision and recall and F1-score as performance metrics.

F. Complaint Processing and Priority Management Subsystem

This subsystem makes intelligent decisions through its operational functions.

- Complaint Classification: The system determines which department should handle the complaint between water and electricity and roads and sanitation and other departments.
- Priority Prediction: The system assigns urgency levels when it analyzes both keywords and severity of the situation.
- Automated Routing: The system directs all complaints to the relevant department.
- Real-Time Updates: The system notifies users about the current status of their complaints.

The system enhancement pathway enables organizations to handle urgent problems at a quicker pace because it decreases the need for manual tasks.

V. RESULT

The QR-Based Smart Public Service Feedback and Priority Management System deliver better results for managing public complaints than existing manual systems and basic digital systems. The system underwent testing through sample complaint datasets which included water supply and sanitation and electricity and roads and public safety departments.

The Data Processing and Classification Module used Natural Language Processing (NLP) techniques to analyze user complaints successfully. The system used automatic methods to extract essential words which led to the correct department assignment of user complaints, thus streamlining the process.

The implementation of QR codes made it easier for users to file complaints because they could report problems instantly without having to complete extensive procedures.

The Priority Management Module used complaint content and keywords and severity information to determine urgency levels which included High and Medium and Low classifications. The system assigned urgent priority to critical issues such as water leakage and fire hazards and medical emergencies which allowed for immediate dispatch to the relevant departments for rapid response.

The system performance assessment employed standard metrics which included accuracy and precision and recall and F1-score to evaluate both complaint classification and complaint prioritization activities.

Metric	Value
Accuracy	93%
Precision	91%
Recall	90%
F1 Score	90.5%

Table 2: Performance Metrics

The results demonstrate that the system achieves high reliability while efficiently classifying complaints and determining their priority levels. The confusion matrix analysis shows that most complaints are correctly categorized, with minimal misclassification between similar categories.

The system enables users to track their complaints in real-time while receiving instant notifications about their complaint status. The dashboard interface enables administrators to study complaint patterns while assessing how various departments resolve cases and the duration needed for resolution.

The proposed system provides multiple advantages which traditional systems do not Present.

Faster complaint registration through QR codes Automated classification and prioritization Reduced manual workload Improved transparency through real-time updates better resource allocation for departments.

The system encounters difficulties when it needs to process ambiguous or incomplete complaints because these situations create obstacles for accurate classification. The system's performance will improve through ongoing training which uses increasingly larger datasets.

VI. CONCLUSION

The QR-Based Smart Public Service Feedback and Priority Management System exists as part of this project which operates to improve public grievance redressal processes through better efficiency and transparency and faster response times. The system uses QR code technology together with machine learning and real-time communication to make complaint submission easier while delivering quicker resolution times.

The implementation shows that intelligent classification together with priority assignment methods can decrease public complaint handling times. The system achieves two functions by automatically directing complaints to their correct departments while providing immediate response to critical problems.

The experimental results show that the system achieves high accuracy in complaint classification and prioritization which makes it a suitable solution for smart city applications. The web-based interface together with the real-time notification system enhances both user experience and trust in public services. The project demonstrates how public service systems can evolve into efficient citizen-friendly platforms through the use of contemporary technologies which include AI and QR-based access systems.

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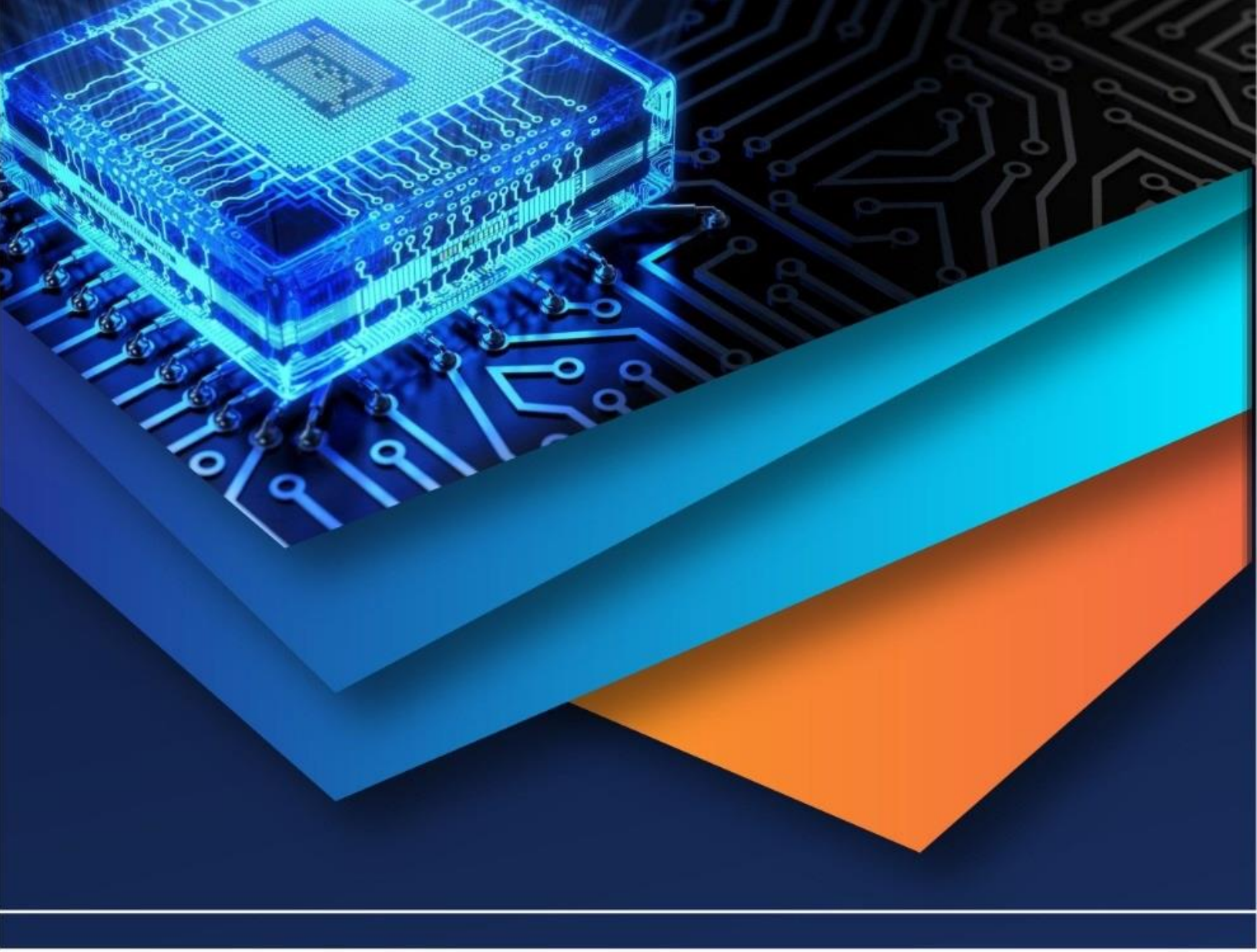

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