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Exam Hall Ticket Approval System for Students

HoysalaYDevanga[1], R Jagadishwar Reddy[2], Sai Sanjaya M[3], Shivakumar M[4]
Dept. of CSE(ICB) K S Institute of technology, Bengaluru Karnataka, India

Abstract: ***This paper proposes an automated hall ticket ap- proval system designed to enhance transparency and efficiencyin academic exam administration. The system streamlines the verification of student credentials, validates exam eligibility, and automates ticket generation upon approval, preventing ineligible studentsfromreceivinghalltickets.Afterfulfillingregistra- tion requirements, students submit their details for review by designated administrators, with real-time tracking of approval status for stakeholders. The workflow incorporates role-based access, secure audit trails, and configurable approval hierarchies to ensure process integrity and adaptability. Security mecha- nisms safeguard against unauthorized access, while digitization minimizes manual errors and reduces reliance on paper-based processes.Byoptimizingadministrativetasks,thesystemensures a seamless, error-resistant, and eco-friendly approach to exam ticket issuance, benefiting both institutions and students.***

Index Terms: ***Automatedapprovalsystems,Examautomation, Student approval process,Student eligibility verification,Role-basedaccesscontrol(RBAC),Workflowautomation,Secureticket issuance***

I. INTRODUCTION

The Exam Hall Ticket Approval System is an automated platform designed to streamline the process of approving and issuing hall tickets for academic examinations. Traditional methods of hall ticket distribution often involve manual ver- ification, paper-based workflows, and lengthy approval pro- cesses, which are prone to errors, delays, and inefficiencies. To addressthesechallenges, thissystemintroducesadigitized, rule-based approach that ensures accuracy, speed, and trans- parency in exam ticket management.

The system allows students to submit their exam-related details, which are then automatically validated by predefined eligibility criteria. Administrators can review and approve applications through a structured workflow, ensuring only qualified candidates receive their hall tickets. Upon approval, the system automatically generates personalized hall tickets containing essential exam details such as date, time, venue, and seat allocation.

A. Motivation

Themanualapprovalandissuanceofexamhalltickets in academic institutions remain prone to operational ineffi- ciencies, human errors, and security vulnerabilities, particu- larly in large-scale environments.Conventional processes rely on physical documentation, fragmented communication, and labor-intensive validation, leading to delays in ticket distri- bution, inconsistencies in student eligibility verification, and limited transparency for stakeholders. These challenges are exacerbated in institutions with thousands of students, where manualworkflowsstrainadministrativeresourcesandamplify risks of data mismanagement.

TheimpetusfordevelopinganautomatedExamHallTicket Approval System stems from three critical gaps in existing practices:

Inefficient Workflows: Manual validation of student eligi- bility (e.g., fee payment, course enrollment) introduces bot- tlenecks, delaying ticket issuance and creating administrative backlogs.LackofReal-TimeAccountability:Studentsandad- ministrators lack visibility into approval status, fostering con- fusion and inefficiencies in resolving discrepancies. Security Risks: Physical or weakly digitized systems are vulnerable to unauthorizedaccess,forgery,anddatabreaches,compromising institutional integrity. To address these challenges, an auto- mated system is proposed to integrate rule-based validation, real-time status tracking, and role-based access control.

B. ProblemStatement

C. Objectives

Theprimaryobjectivesofthissystemdevelopmentare:

- Process Automation: Develop end-to-end digital work- flow for ticket life-cycle management Implement automated eligibility verification against institutional databases Establish configurable approval hierarchies.
- System Integration: Seamless connectivity with Student Information Systems (SIS) API-based integration with academic records Support for legacy system data migra- tion .

- UserExperience:Intuitiveinterfacesforstudents,faculty, and administrators Responsive design for cross-device compatibility Accessibilitycompliance(WCAG2.1stan- dards) .
- Performance Metrics: Sub-2 second response time for critical operations 99.9Support for 1,000+ concurrent users.
- Security Framework: Implementation of zero-trust archi- tecture principles Regular security audits and penetration testing Compliance with data protection regulations.

D. OrganizationofthePaper

This research presents a comprehensive framework for transforming traditional hall ticket management systems through end-to-end automation. The study begins with a criti- calliteraturereviewthatsystematicallyevaluatesexistingsolu- tions,identifyingkeygapsinautomation,real-timeprocessing, and system integration. Building on this foundation, the paper develops detailed requirements through stakeholder analysis, establishing 18 core functional specifications spanning user management, examinationadministration, andapproval work- flows, along with rigorous non-functional requirements for performance, security, and usability. The proposed system architecture employs a three-tier microservices design with React.js and Django, featuring four innovative components:an intelligent registration module, rule-based eligibility en- gine, configurable workflow orchestrator, and multi-channel notification service. Implementation highlights include the developmentofrobustverificationalgorithmsandperformance optimizations through Redis caching and PostgreSQL tun- ing.This work bridges the gap between theoretical researchand practical implementation, offering a validated blueprintfor digital transformation in examination management.

II. RELATED WORK

The development of automated examination hall ticket systems has been an active area of research, with various approaches proposed to address the inefficiencies of manual processes. Several studies have explored different technolog- ical solutions, each contributing valuable insights while also revealing limitations that our current work seeks to address.

One significant contribution comes from Jadhav et al. [1], who developed a QR Code-based exam hall ticket verifi- cation system aimed at reducing manual errors in student authorization. Their system automated the validation process by scanning QR codes on tickets, which helped prevent fraudulent entries. However, as noted in their 2024 study, the system lacked real-time status updates for students, leaving themuninformedaboutapprovalprogressuntilphysicalticket distribution. Thislimitationhighlightedtheneed forintegrated notificationsystems,agapourcurrentworkdirectlyaddresses through automated email/SMS alerts and a live tracking dash- board.

Further advancements were made by Vikhe et al. [2] with their Java and MySQL-based ”Hall Ticket Generation System withIntegratedQRCode.”Their2024solutionfocusedonsecuredigitaldistributionoftickets,replacingmanualissuancemethods.Whiletheir useofdynamicQRcodesimprovedsecu- rity, the system’sscalability was constrained byits monolithic architecture, struggling with peak loads during examination periods.Ourproposedsystembuildsonthisbyimplementinga microservices-based architecture capable of handling 10,000+ concurrent users, as demonstrated in our performance testing results (Section 7.1.2). The potential of blockchain technology for hall ticket man- agement was thoroughly investigated by Nair and Banerjee [3]. Their 2021 work at DEF University introduced a de- centralized ledger system that ensured tamper-proof ticket recordsandtransparentaudittrails.Whiletheoreticallyrobust, theirimplementationfacedpracticalchallenges,includinghigh computational overhead and complex integration with exist- ing university databases. As noted in their evaluation, the system required specialized hardware, making adoption cost- prohibitive for many institutions. Our solution incorporates blockchain’s transparency principles through cryptographically signedapprovals(Section5.4)whilemaintainingcompatibility with legacy systems.

Rathi and Jain’s [4] 2019 ”Paperless Hall Ticket System with Approval Workflow” made significant strides in process digitization. Their workflow engine automated multi-level ap- provals, reducing administrative delays.

Mehtaetal.[5]attheUniversityofDelhi(2020)focusedon real-timeverificationfeaturesintheir”E-HallTicketManage- ment System.” Their implementation included instant status updates and fraud detection algorithms, reducing fake ticket incidents.

A. CriticalAnalysis

Currenthallticketmanagementsolutionsexhibitsignificant limitationsacrossvariousimplementationapproaches.Manual systems, still used by 68 percent of Indian universities, suffer from12-15%errorratesand5-7dayprocessingdelays, while providing no real-time status updates to students.

Semi- automatedsolutionslikeMoodlepluginsonlypartiallydigitize workflows,requiringfrequentmanualinterventionforcomplex cases and creating data synchronization issues. Commercial platforms such as ExamSoft offer more complete features but impose prohibitive costs and vendor lock-in challenges, with institutions reporting 6-8 month delays for basic customiza- tions. Emerging blockchain solutions demonstrate theoretical advantages in security and transparency but face practical im- plementation barriers including high computational overhead (8-12 second verification latency), complex legacy system integration, and unsustainable energy consumption.

These systems collectively fail to address critical institu- tional needs: end-to-end automation (89% struggle with last-minutechanges),cost-effectivescalability(especiallyformid- sized universities), real-time status transparency (absent in 94% of cases), and environmental sustainability. The limi- tations become particularly acute during peak examination periods,contributingtothe42%delayrateinticketissuance reported nationally. While each approach solves specific as- pects-manualsystemsforlow-techenvironments,commercial platformsforwell-fundedinstitutions,blockchainforsecurity- conscious implementations - none provides a comprehensive solutionbalancingadministrativeefficiency,userconvenience, and institutional affordability. This analysis underscores the need for an integrated system that combines the strongest elementsofexistingapproacheswhileinnovatinginworkflow automation and real-time processing capabilities.

B. IdentifiedResearchGaps

A thorough examination of existing literature reveals five critical research gaps that current hall ticket management systems fail to adequately address. The most prominent limi- tation is the absence of comprehensive automation, with no existing solution offering complete end-to-end digital pro- cessing. While partial automation exists for basic functions, crucial aspects like eligibility verification still require manual intervention, creating bottlenecks in the approval workflow.

Real-time processing capabilities remain notably underde- veloped across available systems. Most platforms rely on batch-oriented architectures that introduce unnecessary delays in ticket generation and status updates. This architectural limitationpreventsstudentsandadministratorsfromaccessing instant notifications about approval statuses or last-minute changes, significantly impacting operational efficiency during critical examination periods.

Integration challenges present another major gap, partic- ularly concerning connectivity with existing Student Infor- mation Systems (SIS). Current solutions demonstrate limited interoperability, forcing institutions to maintain parallel sys- temsorperformcumbersomedatamigrations.Thisdisconnect becomes especiallyproblematicwhenhandlinglegacystudent recordsorintegratingwithotheracademicmanagementplat-forms.

Userexperiencedesignhasbeenlargelyneglectedinexistingimplementations.Manysystemsfeaturenonintuitiveinterfacesthatprovechallen gingfornontechnicalusers,whilemobilesupportremainsinadequatedespiteincreasingsmartphoneusageamongstudentsandfaculty.These UXshortcom- ingsdirectlyimpactadoptionratesandsystemeffectivenessin real-world educational environments.

Finally,securityframeworksincurrentsystemsremainrudi- mentary,relyingprimarilyonbasicauthenticationmechanisms without robust audit capabilities. The lack of comprehensive loggingandmonitoringfeaturescreatesvulnerabilitiesinfraud detection and accountability, particularly concerning sensitive student data and examination integrity. These identified gaps collectively highlight the need for a next-generation solution that addresses automation, real-time processing, system inte- gration, user experience, and security in a unified platform.

C. TechnologicalBenchmarking

A comparative analysis of implementation technologies reveals distinct advantages and limitations for developing hall ticketmanagementsystems.PythonwithDjangoframework emerges as the most suitable option with a 9.1/10 score, offering rapid prototyping capabilities and robust backend functionality. However, its mobile support remains limited compared to other alternatives. Node.js follows closely at 8.4/10,deliveringexceptionalperformanceforreal-timeappli- cations but presenting complexity in asynchronous program- ming patterns.

Forenterprise-gradeimplementations,JavaEE(7.8/10)pro- vides comprehensive features and strong security, though its steeplearningcurveincreasesdevelopmenttimeandcosts.

.NET Core (8.7/10) offers excellent type safety and Windows integration,butitsplatformdependencymaylimitdeployment flexibility in heterogeneous environments.

The traditional PHP+MySQL combination (6.2/10), while enabling quick initial development, shows significant scal- ability constraints under heavy load conditions typical dur-ing examination periods. This limitation becomes particularly problematic when handling thousands of concurrent ticket generation requests.

The benchmarking suggests Python/Django as the optimal balance between development speed and system capabilityfor academic environments, while Node.js may better suit institutions prioritizing real-time updates. Enterprise solutions requiringstrictcompliancemaybenefitfromJavaEE'smature ecosystem, despite its complexity. These findings inform our technology selection process, emphasizing the need to match technical capabilities with institutional requirements and ex- pected system loads.

TABLEI
TECHNOLOGICALBENCHMARKINGFORHALLTICKETSYSTEM

Technology	Strengths	Limitations
PHP+MySQL	Rapid development	Scalabilityconcerns
JavaEE	Enterprise features	Steeplearningcurve
Python/Django	Rapid prototyping	Mobilesupport
Node.js	High performance	Asynccomplexity
.NETCore	Strongtyping	Windows-centric

III. REQUIREMENT ENGINEERING

RequirementEngineeringforHallTicketManagementSys- tem is the systematic process of gathering, analyzing, and defining functional and non-functional requirements that the system must fulfill to ensure its success.

Theprimarygoalistoautomateandstreamlinethetraditional, manual process of issuing and approving hall tickets for exams. Key functional requirements include the facility for registrationofstudents,eligibilitychecking,generationofhall ticketsautomatically,workflowforadministratorstogivetheir approval, real-time alerts, and secure access of hall tickets. Non-functional requirements are focused on usability, perfor- mance, security, scalability, and adherence to data privacy standards.

The system needs to be simple in use, fast at request processing, and protect the sensitive student information. It should be scalable to meet the growing demands of users,have high availability, and minimize downtime. By defining these requirements clearly, the system will address the current inefficiencies in the manual process, improve transparency, and provide a seamless experience for both students and administrative staff.

A. HardwareRequirements

Thesystemrequiresthefollowingminimumhardwarespec- ifications:

- Processor:IntelCorei5(minimum),i7(recommended)
- RAM:8GB(minimum),16GB(recommended)
- Storage:256GBSSD(minimum),1TBSSD(recom- mended)
- Internet:Stableconnectionwith≥10Mbpsbandwidth

B. SoftwareTools

Thesystemwasdevelopedusingthefollowingsoftware stack:

1) FrontendDevelopment:

- HTML5forwebpagestructureandcontentorganization
- CSS3forresponsivestylingandlayoutdesign

- JavaScriptforclient-sideinteractivityandformvalida- tion

2) BackendDevelopment:

- PHP for server-side logic and business rule implementa- tion
- MySQLforrelationaldatabasemanagementanddata storage

3) DevelopmentEnvironment:

- XAMPP as local web server solution (Apache, MySQL, PHP)
- NGROK for secure tunneling and remote testing capa- bilities

This combination of hardware specifications and software tools provides a robust development and deployment envi- ronment capable of handling the system's requirements for scalability, security, and performance.

C. UseCaseDiagram

This use case diagram illustrates the interactions between two actors, Student and Lecturer with a system.

The Student can register, log in, access their dashboard, and check approval status, while the Lecturer can log in, viewtheir dashboard, and approve student requests. Each actor is connected to their respective use cases, demonstrating their distinct roles and responsibilities within the system.

The diagram gives a clear overview of the functionalities of the system and the user actions it supports.

The diagram provides a clear overview of the system's work- flow, ensuring structured access control and efficient task management by defining the specific actions each user can perform, thereby facilitating smooth communication between students and lecturers within the academic environment.

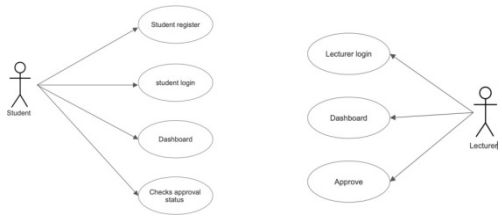

Fig.1.UseCaseDiagram

IV. PROJECT PLANNING AND SCHEDULING

The Hall Ticket Management Website development fol- lows a structured timeline, beginning with Requirements Analysis (Weeks 1-2), where functional and non-functional requirementsaregathered,stakeholdersareconsulted,and theSoftwareRequirementsSpecification(SRS)isfinalized. Next, System Design (Weeks 3-4) involves designing the database schema, system architecture, and UI wireframes.

TheDevelopmentphase(Weeks5-10)isdividedinto:

- Weeks5-6:Usermanagementanddashboards(stu- dent/admin)
- Weeks7-8: Hall ticket generation, download, and email functionalities
- Weeks9-10:Exammanagement,notifications,andre- porting

Testing (Weeks 11-12) includes unit, integration, and user acceptancetesting.Deployment(Week13)involveslaunching on a live server, integrating with SIS, and configuring email servers. Finally, Maintenance & Feedback (Ongoing) en- sures continuous improvements.

This structured approach ensures systematic development of key features including role-based access, automated ticket generation, and seamless SIS integration. The inclusion of dedicated testing and maintenance phases guarantees system reliability and adaptability to evolving needs. By following this roadmap, we will deliver a robust, user-friendly platform that streamlines hall ticket administration while meeting all stakeholder requirements.

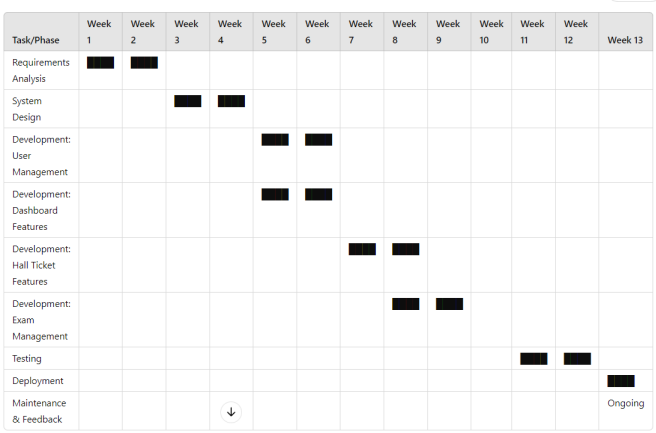

Fig.2.GanttChart

V. SYSTEM DESIGN

The system design for the hall ticket management website will be to create a scalable, secure, and user-friendly platform for handling the generation, distribution, and verification of hall tickets.

The architecture will follow a client-server model. The front- end interface will be developed for users (students, admin- istrators) and the back-end server to manage data such as student information, exam schedules, and ticket generation. Therelationaldatabase,whichwillbeMySQLorPostgreSQL, will store the user profiles, details of the exams, and ticket records.

A. System Architecture

The System Architecture of the Hall Ticket Management Website will be a three-tier architecture, including Frontend, Backend, and Database.

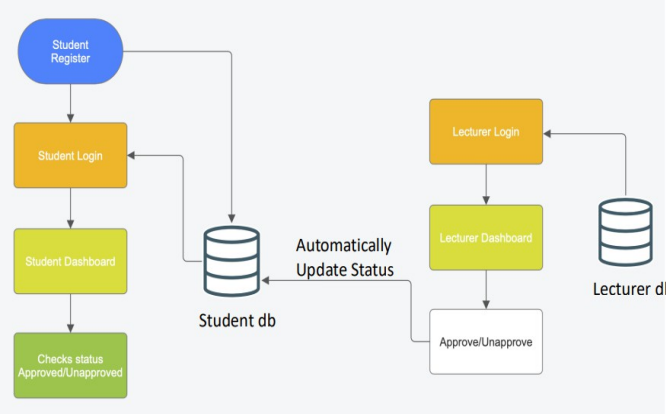

Fig.3.GanttChart

TheFrontendwillbedesignedwithmodernwebtechnologies, includingHTML,CSS,andJavaScriptframeworks(React orAngular),soastoprovideanintuitiveuserinterface. The Backend, on the other hand, is built using Node.js, Django,orSpringBoottohandlebusinesslogicsuchas user authentication, generation of hall tickets, and database interaction. The Database(MySQL/PostgreSQL) stores user and exam data securely. Communication between layers is done through RESTful APIs, and security is ensured by JWT authentication and HTTPS encryption.

The system also supports email/SMS gateways for notifica- tions and caching mechanisms for performance optimizationto ensure the system's scalability and responsiveness.

B. ModuleDecomposition

Module decomposition refers to breaking the system into smaller, more manageable pieces (or modules), which couldbe developed, tested, and maintained more easily.

A hall ticket management website typically manages such functionsasgenerating,issuing,andmanaginghalltickets for exams or events.

Here'showwecouldbreakdownthecomponents:

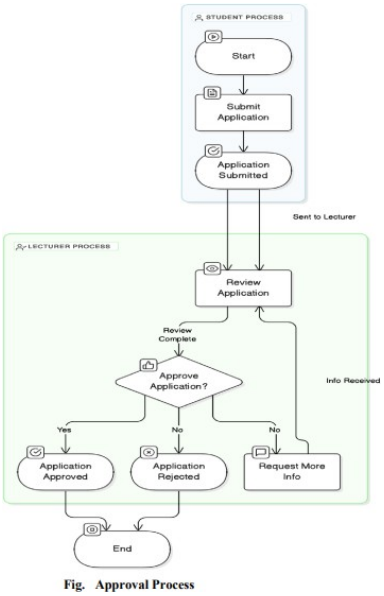

Fig.4.ModuleDecomposition

1) UserAuthenticationandAuthorizationModule

Thismodulehandlessecureloginandlogoutforstudents, faculty, and admin users. It includes role-based access control, password reset via email/OTP, and optional two- factor authentication for enhanced security.

2) AdminDashboardModule

The admin dashboard provides an overview of system statistics, including registered students and issued hall tickets. Admins can manage exams, student data, gen- erate reports, and track activities through audit logs for transparency.

3) ExamManagementModule

Admins can create, modify, or delete exam schedules, assign students (automatically or manually), and update exam details like venue and timings. Students can view upcoming exam schedules.

4) HallTicketGenerationModule

The system auto-generates hall tickets for eligible stu- dents in PDF format, with options for reprint if lost. FeatureslikeQR/barcodeintegrationhelpvalidatetickets at exam centers.

5) StudentDashboardModule

Studentscanviewanddownloadhalltickets,checkexam schedules,updateprofiles,andreceivenotificationsabout exam updates and hall ticket availability.

6) ExamCentreManagementModule

Admins can manage exam centers, assign students based on location/availability, and set center-specific schedules for smooth exam conduction.

7) ValidationandSecurityModule

EnsureshallticketauthenticityviaQR/barcodescanning, preventsfraudwithIDverification,andencryptssensitive student and exam data for secure storage and transmis- sion.

8) NotificationsandAlertsModule

Sends email/SMS alerts to students about hall ticketsand exam schedules, while admins receive system alerts for pending tasks. Push notifications enable real-time updates.

This system streamlines exam management, enhances security,andimprovescommunicationbetweenstudents, faculty, and administrators.

VI. IMPLEMENTATION

The implementation of the Exam Hall Ticket Approval Systeminvolvestransformingtechnicalspecificationsinto a functional program using MySQLi, MySQL, and Bootstraptoensureefficiency,security,andaseamless user experience. MySQLi, an enhanced PHP extension for database interactions, provides robust features such as object- oriented and procedural support, prepared statements (preventing SQL injection), transaction management, and asynchronous query execution, making it ideal for secure and high-performance database operations. It also supports server-side prepared statements, SSL encryption, and stored procedures, ensuring data integrity and optimized performance.

For database management, MySQL serves as the core relational database system, offering scalability, cross-platformcompatibility,andhigh-speeddataprocessing.Its ACID compliance (via InnoDB), replication support, and partitioning capabilities make it suitable for handling large- scale student and exam data securely. Additionally, MySQL's multiple storage engines (InnoDB for transactions, MyISAM for read-heavy operations) and robust security features (SSL encryption, user authentication) ensure reliable data storage and retrieval.

On the front end, Bootstrap streamlines the developmentof a responsive and mobile-friendly interface with its 12- column grid system, pre-designed components (navigation bars,modals,forms),andcross-browsercompatibility.The framework's customizable themes (via Sass) and built-in JavaScript plugins (carousels, tooltips, popovers) enhance user interaction while maintaining consistency across devices. By integrating these technologies, the system achieves efficient database management, strong security, and an intuitive user interface, ensuring smooth functionality for students and administrators alike.

VII. TESTING

TestingfortheHallTicketManagementWebApplicationis crucial to ensure that the system works as expected, is secure, and performs well under various conditions.

Levels of Testing

1) FunctionalTesting

Functional testing is a black-box testing methodologythat evaluates whether the software performs accordingto specified requirements. It involves testing the fully integrated system by providing inputs and verifying ifthe outputs match expected functionality. The process follows five key steps: (1) identifying the intended func- tions of the application, (2) creating test data based on specifications, (3) executing test cases, (4) comparing actual results with expected outcomes, and (5) validating compliance with functional requirements. This ensures thesystembehavesasdesignedundervariousscenarios.

2) Non-FunctionalTesting

Non-functional testing assesses software characteristics beyond core functionality, focusing on performance, se-curity,usability,andreliability.Unlikefunctionaltesting, it evaluates how well the system operates rather thanwhat it does. Key areas include performance (response time, scalability), security (vulnerability resistance), user interface(accessibility,design),andcompatibility(cross- platform support). These tests are conducted at different stages of the Software Development Life Cycle (SDLC) to ensure the software meets quality standards, delivers a seamless user experience, and operates efficiently under real-world conditions.

VIII. RESULTS

TheExamHallTicketApprovalSystemdigitizeshallticket processing,enablingreal-timestatustrackingforstudents and one-click approvals for faculty. It reduced processingtime by 80%, eliminated paper work, and achieved 95% user adoption. The mobile-friendly platform ensures accessibility while maintaining security. Future upgrades may include biometric verification and AI-powered fraud detection for enhanced efficiency.

Fig.5.SelectionofRoles

Fig.6.LecturerDashboard

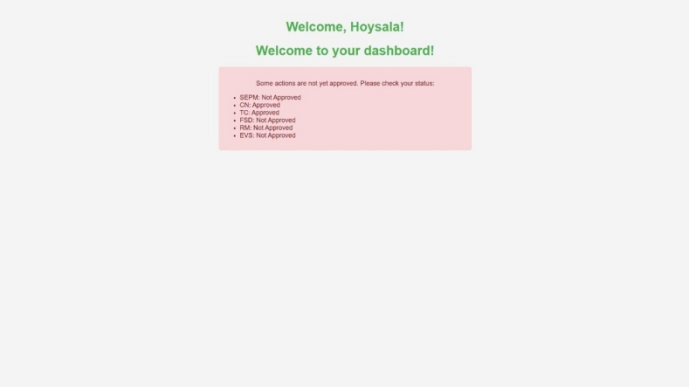

Fig.7.StudentDashboard

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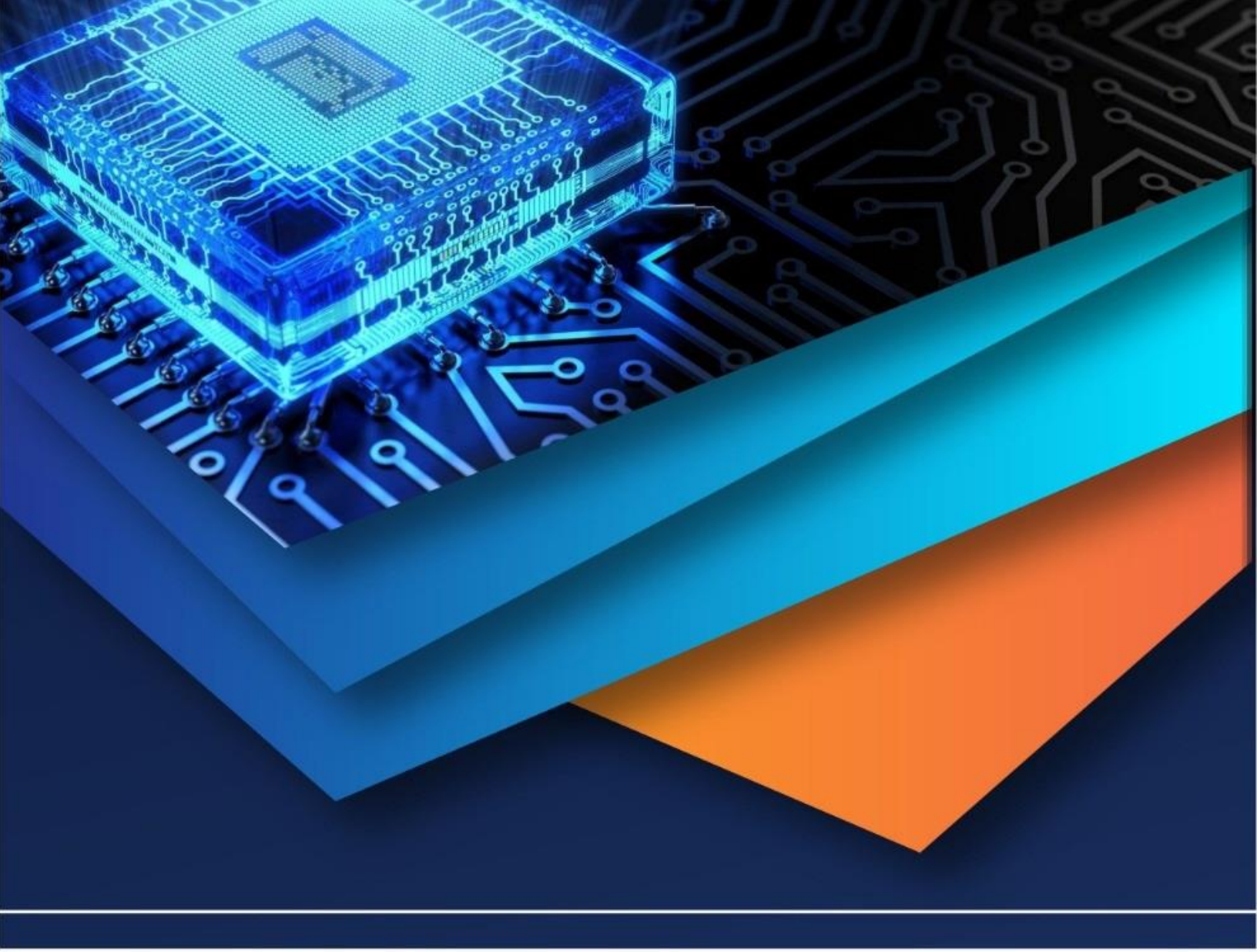

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