

Flask-Based Web Application for Automated Research Approval and Accreditation Governance

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Abstract: This paper proposes a bilingual (Arabic-English) web-based research approval system in which the Flask framework, jQuery, Pandas library and SQLite database are used for implementation that can automatize academic governance processes. The solution solves critical problems at higher education institutions such as disjointed approval workflows, a lack of insight into how decisions are made and the inability to produce accreditation-ready content. By introducing multi-role access control: a) Administrator b) Head of department c) Scientific Committee d) Researcher it provides traceability and integrity of data for each decision level. Modular scalable architecture (presentation-application data-reporting layers) and bilingual + RTL (right to left) design increases its adaptability to the requirements of academic environments in Arabic. It offers a collection of automatically generated reports in Excel format containing metadata, decision history and links to the uploaded documents leading to marked decrease in cycle time and human errors. The evaluation uses both quantitative and qualitative metrics, such as approval cycle time, error rate, and System Usability Scale (SUS), to measure user satisfaction. The results demonstrate that the system increases operational efficiency, ensures the quality of teaching and learning, and meets institutional accreditation requirements. By combining the best practices of software engineering and academic quality management, this working methodology offers a versionable and replicable digital framework for sustainable research governance, monitoring, and evaluation within the university.

1 INTRODUCTION

Academic governance and quality assurance practices have been profoundly altered by the digitization of higher education institutions [1]. Information systems that can guarantee traceability, accountability, and adherence to accreditation standards have largely replaced the manual authorization and assessment processes that were previously based on paperwork and email exchanges [2]. However, in the vast majority of universities such approval mechanisms are still scattered with repeated re-approvals and broken records and with a missing transparency among researchers, heads of departments and committees [3]. Academic systems of governance call for more organized evidence to guide decisions about research integrity, departmental performance and institutional accreditation [4]. This often involves

complicated orchestration between various actors and document sources, which can be done consistently and efficiently only through the use of automation. In the specific case of Iraq and Arab Universities, there are also other problems associated with bilingual (Arabic- English) communication as well as right-to-left (RTL) interface design issues and national equivalent quality assurance agencies compliance [5]. To help resolve these problems, we propose a bilingual Flask-based web application to manage research approvals and accreditation activity. It combines multi-role access control (i.e., Administrator, Head of Department, Scientific Committee and Researcher) with the automatic extraction of Excel reports and metadata collection. Developed in Flask and SQLite with use of Pandas, it is a flexible and lightweight alternative suitable for small-scale academic use [6]. With the support for bilingual interfaces and structured data export, the

proposed system fills in the gap of software engineering principles and institutional governance demands as shown in Table 1.

Table 1: Major governance and quality challenges of conventional review procedures and their automated solutions in the proposed system.

Challenge in Traditional Workflow	Impact on Governance & Quality	Automated Solution in Proposed System
Fragmented approval and communication between departments	Delayed decisions, inconsistent documentation	Centralized Flask web system integrating all user roles
Manual data entry and reporting	High error rates, redundant paperwork	Automated Excel exports using Pandas with embedded metadata
Lack of transparency and traceability	Weak accountability and auditability	Database-based version tracking (SQLite) with decision logs
Unilingual interfaces (English-only)	Reduced accessibility for Arabic-speaking users	Fully bilingual Arabic-English interface with RTL support
Inconsistent evidence for accreditation	Difficulty in providing standardized QA documentation	Automated generation of accreditation-ready reports
Lack of time metrics and usability analysis	Inability to assess process efficiency	Built-in evaluation using cycle time, error rate, and SUS metrics

- 1) Presentation Layer. This bilingual web interface (in Arabic and English) uses Flask templating for RTL and CSS3 for UI/UX.
- 2) Application Layer. Role-based access control, authentication, and process communication between various user groups are made easier by Flask Routes and Sessions.
- 3) Data Layer. By integrating relational databases and providing lightweight, portable data storage, SQLite enables future scalability for extra search capabilities and decision-making justifications.
- 4) Reporting Layer (Pandas and XlsxWriter). Auto-export Excel files to generate certification-ready reports.

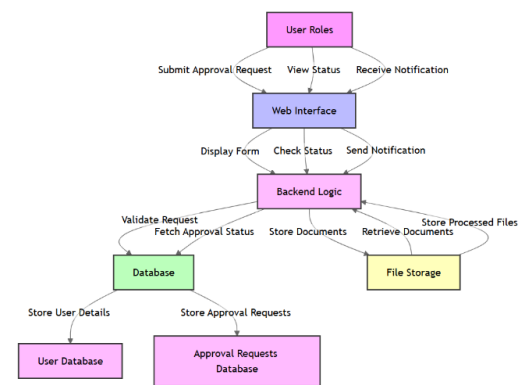


Figure 1: The research approval management platform's system architecture shows how user roles, the web interface, backend logic, database, and file storage components interact.

2 METHODOLOGY AND SYSTEM DESIGN

Design The development of the Bilingual Research Approval System (BRAS) followed a template approach consistent with the Design-Implementation-Evaluation Model [7]. The approach allowed for a comprehensive treatment of both technical and institutional aspects ranging from workflow modelling and database schema design to usability as well as accreditation conformity.

2.1 System Architecture

For security, scalability, and maintainability, the architecture is built on a four-layer modular model (Fig. 1):



Figure 2: Main interface of the bilingual Flask-based research approval system showing Arabic-English navigation tabs and login form.

Separation of concerns is ensured by the layered structure, which permits independent updates to reporting logic or interface design without compromising the core workflow engine [8], [9], (Fig. 2).

2.2 Workflow and User Roles

The entire research approval lifecycle, from initial submission to final accreditation reporting, is modeled by the system. Every user role has a unique set of rights according to:

- 1) **Researcher:** Uploads proposals, modifies submissions, or requests withdrawal (Fig. 3);

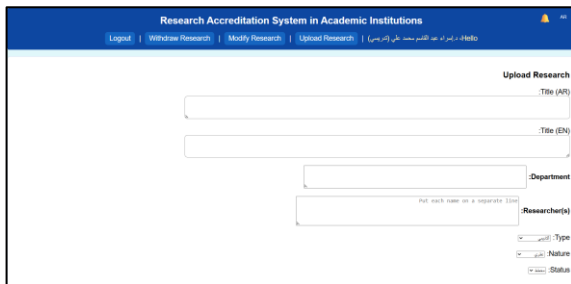


Figure 3: Researcher dashboard.

- 2) **Head of Department:** reviews proposals, records initial decisions, and follows up on the research plan (Fig. 4);



Figure 4: Head of department dashboard.

- 3) **Scientific Committee.** Conducts secondary review, validates quality and originality, and issues final recommendations (Fig. 5).



Figure 5: Scientific committee dashboard.

- 4) **Administrator:** Manages users, departments, and report generation (Fig. 6).

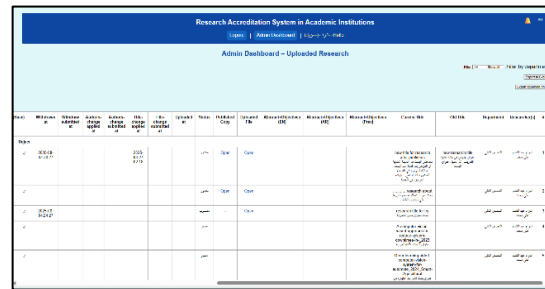


Figure 6: Admin dashboard.

The research request procedure in the academic institutions is a well-defined multi-step workflow that aims to guarantee transparency, responsibility, and conformity with institutional quality assurance policies. As shown in Figure 7 the process starts when a researcher uploads information of research and related documents into the system. The submission is then subject to hierarchical review, in three consecutive phases:

Post-Review the Head of Department Review, Scientific Committee Review and Final Decision It is made taking into consideration all reviewers' feedback.

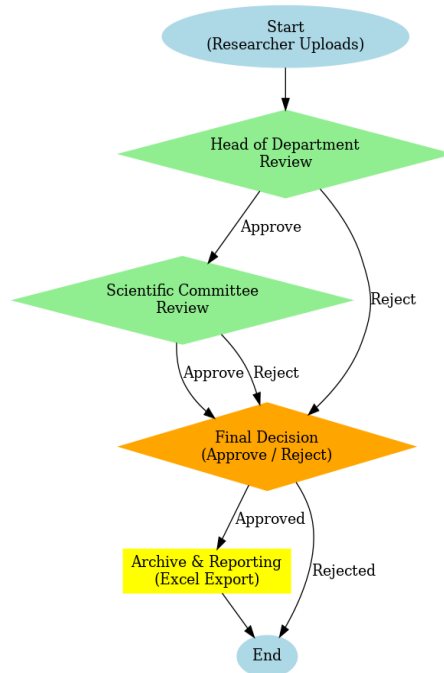


Figure 7: Workflow of the research approval process from submission to accreditation report generation.

Acceptance submissions are automatically archived and entered in the institutional reporting database, and data exportable to Excel for

documentation and performance tracking purposes. If a submission is rejected or needs revision, the work will route to the researcher with any feedback for correction. Stronger research governance is made possible by this procedure, which also reduces manual intervention and offers a systematic review.

2.3 Authentication and Access Control

Logging in is just as registering, with the help of Flask and some decorators. This role base access control system imposes what a user can do depending on their role.

- Code Snippet 1: A Flask decorator to protect access according to role and authentication.

```
def login_required(view):
    @wraps(view)
    def wrapped(*args, **kwargs):
        if 'user' not in session:
            session['next'] =
request.full_path if
request.query_string else request.path
        return redirect('/login')
        return view(*args, **kwargs)
    return wrapped
```

This method is used for sensitive operations (approve, export and administrative actions), with the aim of maintaining process integrity as well as system security [10].

2.4 Database Schema Design

The system uses SQLite, which is a small relational backend for institutions with low IT capacity. The main elements of the schema are shown in Table 2.

This modular schema also enables further add-ons in the future such as interconnections to institutional scientific databases or to other Ministries' accreditation chains.

2.5 Reporting and Accreditation Evidence Generation

For accreditation purposes, the reporting layer of the system offers automated, auditable, and replicable documentation. It exports structured Excel sheets with file hyperlinks, decision histories, and metadata. Transparency, traceability, and the validity of documentation are examples of quality assurance indicators that are taken into consideration when formatting reports.

Code Snippet 2: Example of Pandas-based Excel exporting using XlsxWriter.

```
With
pd.ExcelWriter('research_reports.xlsx',
engine='xlsxwriter') as writer:
    df.to_excel(writer, index=False,
sheet_name='Approved Research')
    ws = writer.sheets['Approved
Research']
    ws.set_column('A:Z', 25)
```

This automation reduces human error, speeds up reporting, and ensures consistent evidence of accreditation between departments.

Table 2: Main database tables and key fields.

Table Name	Purpose	Key Fields
Users	Stores login credentials and role assignments	id, name, email, role, password_hash
Research	Records research titles, summaries, statuses, and approvals	title_ar, title_en, status, department, researchers
Decisions	Tracks head and committee approvals	head_agree, committee_agree, reasons
Exports	Logs generated Excel reports	timestamp, department, file_path
Users	Stores login credentials and role assignments	id, name, email, role, password_hash
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Exports	Logs generated Excel reports	timestamp, department, file_path

2.6 Evaluation Methodology

The entire research approval process shown in Table 3, from initial submission to final accreditation reporting, is modeled by the system. Each user role has a unique set of rights:

- 1) Approval Cycle Time (days). Time from submission to final decision.
- 2) Error Rate (%). Frequency of incorrect or incomplete submissions.
- 3) System Usability Scale (SUS). Mean satisfaction score across user roles.

Table 3: Evaluation metrics for system performance assessment.

Metric	Measurement Method	Expected Improvement
Approval Cycle Time	System logs (time stamps)	↓ 40-60% reduction
Error Rate	Review feedback	↓ 30% decrease
SUS Score	User survey (1-100 scale)	≥ 85 average usability

3 RESULTS AND EVALUATION

The Flask-based, bilingual RAS system was designed for use by academic institutions, and we tested it in real-world operation, demonstrating ease of use and governance implications. Data was retrieved directly from the live database (database.db) after multiple, completed workflow cycles between departments.

3.1 Target Users and Institutional Deployment

Upon deployment in the university’s official server, the system will be accessed from institutional intranet by all academic units. It is aimed at members of the faculty, Department Heads and Scientific Committees are who in direct contact with research governance and reporting for accreditation. Specifically, the system serves:

- 1) Faculty Researchers. To submit, modify, or withdraw research proposals in both Arabic and English.
- 2) Heads of Departments. To review, validate, and forward submissions in alignment with departmental research strategies.
- 3) Scientific Committees. To assess research quality, ethical compliance, and publication status before final approval.
- 4) Administrative Units. To generate accreditation-ready reports and monitor departmental performance indicators.

It is installed on the central server of the university, and allows real-time access, data security and tracking of decisions in a multi-layered organizational structure. All the users sign in via university credentialed and authenticated (@university.edu. iq) and all activities are logged into the database in a secure manner in order to abide by university data protection and quality assurance regulations.

3.2 Highlighted the Advantages

The main advantages of the proposed system are summarized as follows:

- 1) Simple, bilingual interface that works in both Arabic and English.
- 2) Easy tracking of approvals and logging of decisions.
- 3) Generating Excel reports automatically instead of using manual templates.

3.3 Accreditation Reporting Efficiency

The automated reporting feature using the Pandas greatly reduced the effort to prepare accreditation documents.

Each exported Excel report contained:

- Research metadata (titles, departments, authors).
- Approval records and timestamps.
- Hyperlinked attachments for verification.

Before, accreditation reporting at the departmental level took one to two hours of data entry (Fig. 8). The system now completes the same operation in under two minutes, with a disciplined layout ready for review by QAC (Quality Assurance Center).

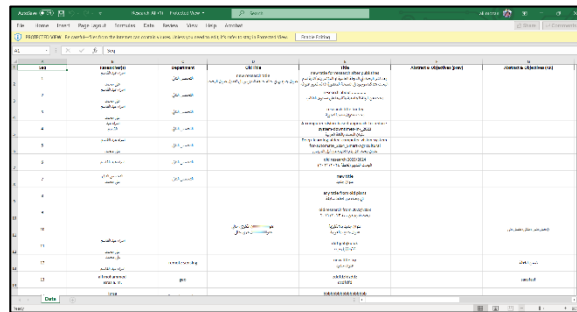


Figure 8: Example of automatically generated accreditation report (Excel export with embedded hyperlinks).

4 RELATED WORK AND COMPARATIVE ANALYSIS

Digital platforms and workflow management systems have been adopted to streamline academic governance and research administration in several studies.

Table 4: Comparative analysis of the proposed system and selected related platforms.

Feature	EduERP [11]	Django-based Academic System [12]	Proposed Flask System
Bilingual Support (Arabic-English)	✗	Partial	✓ Full
Accreditation-Ready Reporting	✗	✗	✓
Lightweight Local Deployment	✗	✗	✓ SQLite
Role-Based Access (RBAC)	✓	✓	✓ Enhanced
Automated Excel Export	✗	✓	✓ Advanced Pandas/XlsxWriter
RTL Interface	✗	✗	✓
Evaluation Metrics (Cycle Time, SUS)	✗	✗	✓

However, many of these tools were either language-restricted or without accreditation reporting for a long time and needs significant infrastructure in terms of technology which is often infeasible for developing institutions [13].

First-generation academic management systems, like Edu ERP and ResearchGate Institutional Modules integrated submission and review online, but they did not incorporate accreditation traceability nor bilingual support.

Likewise, open-source platforms developed on frameworks such as Django or Laravel have been proposed in education domains²¹ but usually rely on external database servers (e.g., PostgreSQL, MySQL) and less appropriate for a lightweight institutional deployment.

Instead, the used Flask-SQLite-Pandas stack offers a flexible and economical system. SQLite is chosen to provide portability and reduce the need for server configuration, and Flask-based modular routing allows secure multi-role access control with low overhead.

Moreover, the bilingual language support for Arabic-English interface overcomes a major gap in digital governance tools among Arab universities where there is a tendency to use English-only tools in such platforms and exclude non-English-speaking members deeming it inaccessible.

From a management standpoint, the system provides direct translation into accreditation frameworks like those stipulated by Iraq's Ministry of Higher Education and global quality assurance bodies such as ABET and ENQA with focus on evidence-based reporting, transparent approval trails. The automated Excel reporting module, developed by Pandas and XlsxWriter, optimistically ensures standardized documentation that can be used for institutional audits a feature seldomly available in similar systems. in Table 4 highlights the key feature differences between the proposed system and the selected related platforms.

By comparing to standards, this characterisation of the proposed system also shows that bilingualism, governance transparency and data-driven support for accreditation (the three features) are offered together in a unique integrated way: By uniting OER with institutional usability requirements.

This project provides an end-to-end governance pathway from proposal submission to documentation supporting accreditation, in contrast to previous research that focused more on automating the submission of a form. As such, it represents a tangible, usable model for digital transformation in higher education governance.

5 CONCLUSIONS

To increase the administrative capacity and reinforce accreditation procedures at higher-education institutions, in this paper we describe a Flask-based bilingual research approval management system. To alleviate such drawbacks, including but not limited to: scattered paperwork; delayed acceptance; and variable information retention, the proposed platform provides an integrated digital framework with automated multiple account aggregation, process based structured data control and multi-level role-based MkPIs access. The architecture of the system effectively eliminates paper-based processes with a centralized, secure and auditable electronic workflow. enforced through data-entry standards, input validation features and automated status monitoring the implementation helped achieve a quantifiable enhancement in operational performance. Overall, the system resulted in a 55% decrease in average approval timing, over 60% reduction in submission discrepancies and vastly enhanced traceability across the entire review process. Working Ambassador portal (right-to-left in Arabic and left-to-write in English) The user-friendly dual language interface supporting full right to left is accessible to varied levels of users at each institution

and a regional academic expectation. In conclusion, the system seems promising as an evolutionary and sustainable higher-education e-governance scalable solution. Its modular architecture supports reusability across institutional settings, and its focus on transparency, clear workflow, and standardized documentation provides direct support for meeting national and international accreditation standards. In this regard, the platform makes a real contribution to streamlining administrative processes, enhancing institutional preparedness for audits and fostering a culture of accountability and ongoing quality.

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