Digital Transformation of Examination Processes: Implementation and Outcomes at GITAM University, Bengaluru Campus

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***Abstract*—This paper explains a digital transformation initiative in the examination section at GITAM University, Bengaluru Campus. The significant challenges include excessive paperwork, long queues, and fragility in administrative work. To address these issues, the institution implemented an integrated, technology-based architecture to streamline the end-of-semester examination process. The proposed method utilises QR-coded answer scripts, QR-based printing of answer sheets, automated seating allocation, mobile-enabled invigilation tools, and real-time monitoring dashboards during Phase 1 of the deployment in April 2024. The results indicate more than a 70% reduction in manual work, a 100% elimination of student complaints, and a post-examination closure time of less than 15 minutes. These outcomes demonstrate enhanced operational efficiency and academic integrity.**

***Keywords*—Examinations, digital, transformation, authentication, biometrics, security, education, students, campus life, dashboard**

***ICTIEE* Track—Assessment, Feedback, and Learning Outcomes**

ICTIEE Sub-Track—Learning Analytics for Evaluation and Improvement

I. INTRODUCTION

EXAMINATIONS play a major role in academic assessments, which measures students learning activity in the academic semester or academic year. A UNESCO report, released in 2002, highlights that over 65% of universities in Asia depend on manual examination processes, despite the availability of digital tools. In India, most institutions suffer from additional challenges, including multi-campus operations and infrastructural constraints. The additional factors leading to inefficiencies are

1. Operational inefficiencies – manual scheduling, redundant paperwork, and delayed coordination.
2. Stakeholder dissatisfaction – student anxiety due to late room assignments, and faculty burdened by last-minute invigilation duties.
3. Integrity risks – exposure to malpractice, question paper leaks, and mishandling of answer scripts.

These challenges were particularly evident at GITAM University's Bengaluru Campus during pre-2024 examination cycles. The examination process still depends on manual operations even though it has Enterprise resource planning system for academic records, room numbers are allocated to faculty based on the different time slots, room allocation were derived from other sheets, the examination question papers are printed in bulky before the exam day, the time is extended for answer script return, this process weighted heavilty on the university and affects all the stake holders in GITAM university. Sometimes, students wait 20 minutes on exam days to find out their allocated room number, which leads to crowding on the notice boards for the seating plan. Exam section coordinators spent nearly three days preparing rooms and finalising seating plans for each exam cycle. The examination department also handled a large volume of paperwork, which is prone to errors and time-consuming. These issues increased operational effort and costs, leading to frustration among students, faculty, and administrators.

II. LITERATURE SURVEY

A study on digital transformation in academic institutions at Izmir Bakırçay University focused on evaluating multiple-choice exam sheets using a digital transformation approach with image processing. The conventional grading method is time-consuming, requires a workforce and is costly. This method detects, crops answer sections, identifies marked choices and generates scores. This system shows 100% accuracy at 600 dpi resolution [1].

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Industry 4.0 and Society 5.0 are reshaping organisational functions, and computer applications are used to digitise processes and provide innovative products, services, and different business models. The education market is also affected by other changes in digitalisation, such as the adoption of an integrated digital transformation model in educational institutions and financial support [2].

Higher education institutions have access to a wide range of technology tools and possess the capability for digital transformation across all dimensions. This approach is one of the emerging fields that can help us understand the complex problems in the system [3]. The numerous barriers to successfully implementing digital transformation necessitate a comprehensive understanding of these barriers, facilitating the development of various strategies and interventions [4]. The real-time knowledge of how to handle digitisation entirely depends on the IT department, and the gap between digitally competent students and inexperienced teachers in handling technology and digitisation costs within the university is also a barrier [5]. The education sector has several implications for the changes brought about by new technologies and trends in digital marketing, leading to Digital transformation [6]. The different Case studies related to digital examination include the University of Pretoria, which utilises a seating allocation system that reduces the time from 5 days to 8 hours, and the National University of Singapore, which employs online assessments for specific domain courses that provide instant grading. Similarly, state government institutions, such as Jawaharlal Nehru University, introduced QR-coded answer scripts to prevent misplacement incidents. The digital exams in Sri Lankan universities [7]. Cornell University [8] uses a programming-based optimisation framework for solving complex final exams. This proposed dashboard supports different courses and different time slots. The University of Mauritius [9] employs an exam scheduling model that utilises front-loading large courses and block-specific time slots. Similarly, the National University of Singapore [10] utilises centralised exam management, supporting e-exams, online proctoring, and automatic timetable generation.

III. METHODOLOGY

A. Research Objective and Scope

The GITAM University's digital transformation objectives are primarily to reduce manual interventions from 88% to 25% and shorten the room allocation time from three days to less than a day. Additionally, to enhance the student experience with instant QR code-based room identification and reduce the post-exam closure time from 3-4 hours to just 10 minutes. Additionally, minimise student complaints to zero. Some of the objectives are shown in Table I.

The April 2024 reforms aimed to:

1. Streamline examination activities via integrated digital systems.
2. Minimise human intervention to reduce errors.
3. Secure examination materials through biometric and digital tracking.
4. Provide live operational visibility to decision-makers.

TABLE I
OBJECTIVES OF THE PROPOSED SYSTEM

Goal	Pre-Reform Baseline	Target (Goal)	Post-Reform Outcome
Reduce manual interventions	88% of the process steps are manual	<30% manual	~25% achieved (−70%)
Speed up room preparation & seating allocation	3 days of effort	<1 day	<1 day achieved (75% faster)
Improve student exam-day experience	10–15 mins to identify rooms	<2 mins	Instant via QR/automated seating
Reduce post-exam closure	3–4 hours	<30 mins	15 mins (88% faster)
Minimise student complaints	25–40 per cycle	Zero	Achieved
Reduce faculty supervision load	10 sessions/semester	~7–8 sessions	40% reduction observed
Ensure transparency & integrity	Error-prone manual logs	Automated secure system	100% integrity ensured
Enable real-time monitoring	No live dashboards	Central dashboards	Achieved

This paper details the background, methodology, implementation, and outcomes of this transformation, offering a case study that bridges traditional paper-based examinations with modern digital management practices.

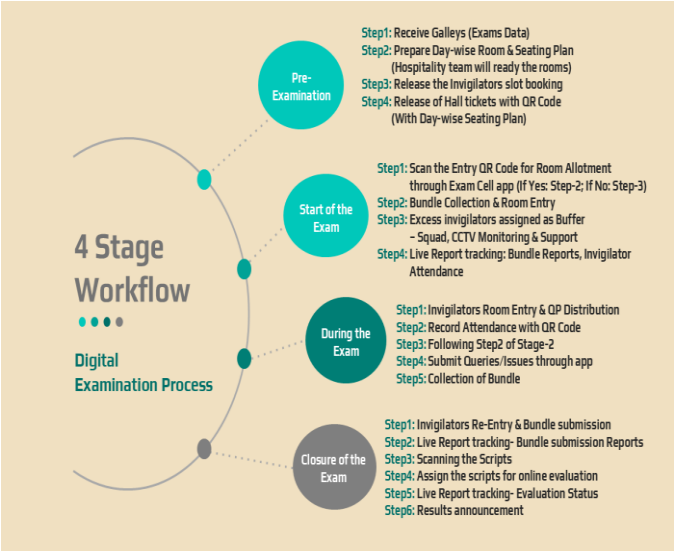

Fig. 1. Flow diagram in the GITAM University examination

Figure 1 illustrates the examination process at GITAM University, comprising four significant steps. Step 1 deals with the pre-examination process, Step 2 explains the start of the exam, Step 3 outlines the process involved during the exam, and

Step 4 describes the process for exam closure.

B. Stakeholder Engagement

1. *Students* – A town hall meeting in the Bengaluru campus is conducted for all students to discuss the exam cell application, especially regarding biometric access and attendance scanning.
2. *Faculty* – University conducted Workshops on mobile invigilation application in both Android phones and iPhones, and also digital evaluation booking.
3. *Support staff* – Training for all non-teaching staff in the university for QR-based classroom readiness and script receiving.

C. Change Management Strategy

The Digital transformation process was planned over six months, with:

1. Exam Reforms Committee formation for leadership faculty and leadership team, which includes the chancellor.
2. Pilot testing in selected departments before launching the application to students and faculties
3. Feedback sessions are introduced to address issues

D. Technology Stack

1. *Automated Scheduling & Seating Allocation* – Generated seating avoiding adjacent roll numbers, integrated with classroom QR codes.
2. *Biometric-secured Printing* – Only authorised personnel could print, with timestamped logs.
3. *QR-coded Answer Scripts* – Linked each script to a database entry for traceable handling.
4. *App-based Invigilation Management* – Mobile access for duty allocation, attendance tracking, and incident reporting.
5. *Live Dashboards* – Real-time progress tracking for senior administrators.

Fig. 2. Digital Technologies

Figure 2 illustrates the four advanced security and monitoring technologies designed to enhance the integrity and efficiency of institutional operations. All closed loop cameras are installed in front and back of each classroom and connected to a web server for live video recording to monitor the students while writing the exam. Each room entry is authorised with fingerprint authentication, which supports confidentiality. The exam room is divided into three categories: the printing room, the storage room, and the live monitoring section, which is accessible to a select few people.

IV. IMPLEMENTATION

A. Investment and ROI Measurement

- *Digital Infrastructure*: This includes upgrades such as servers, biometric-secured printing systems, and related hardware to support secure exam operations.
- *Software Development & Testing:* Focused on building and validating features like QR-code-enabled answer scripts, automated seating allocation, and real-time monitoring dashboards.
- *Deployment & Training:* Covered phased implementation, orientation, and training sessions for faculty and examination staff to ensure smooth adoption.
- Significant reduction in time and manual effort.
- Manpower hours saved, e.g., room preparation reduced from 4 days to 1 day, saving over 100 faculty hours per exam cycle.
- Faster post-exam closure, freeing examination staff for other academic responsibilities.
- Higher student satisfaction, evidenced by zero complaints in the post-reform phase.
- Improved transparency and credibility in examination processes.

B. Pre-Examination Phase

- Automated generation of classroom assignments from Gally sheets.
- Early readiness verification via QR scans.
- Question paper printing was performed just in time under biometric access control.

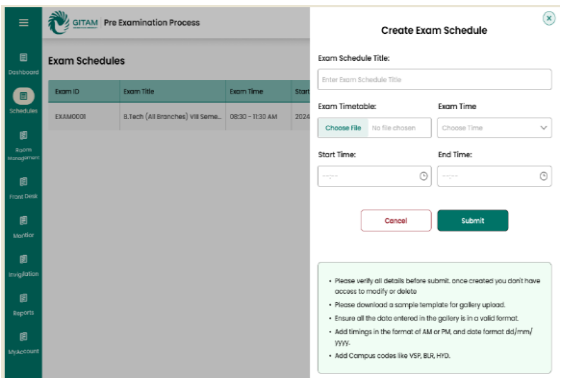

Fig. 3. Pre-Examination process

Figure 3 shows a user interface from the GITAM Pre-Examination **Process** portal, specifically designed for creating and managing **exam schedules**. The table on the left side of the image displays columns such as Exam ID, Title, Time, and Date. On the right side of the image is the 'Create Exam

Schedule' section, where teaching or non-teaching staff can enter details such as the exam schedule title, upload a timetable file, select the exam time, and specify the start and end times.

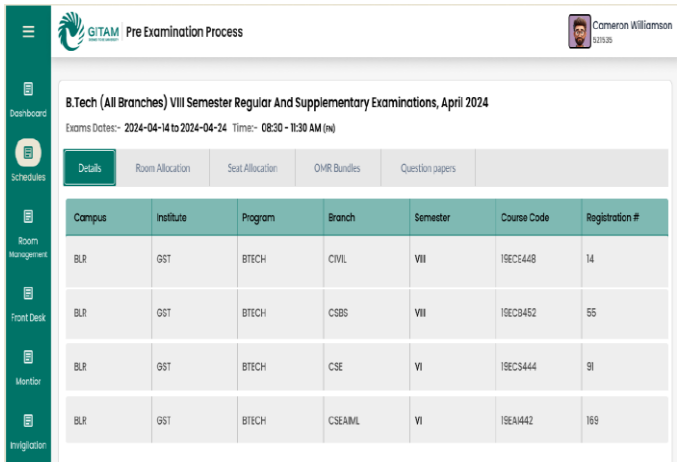

Fig. 4. Dashboard for the pre-examination process

Figure 4 shows the Pre-Examination Process portal dashboard, specifically the schedule for B.Tech (All Branches) VIII Semester Regular and Supplementary Examinations scheduled for year-end exams. This table includes the following columns: Campus, Institute, Program, Branch, Semester, Course Code, and Registration Number.

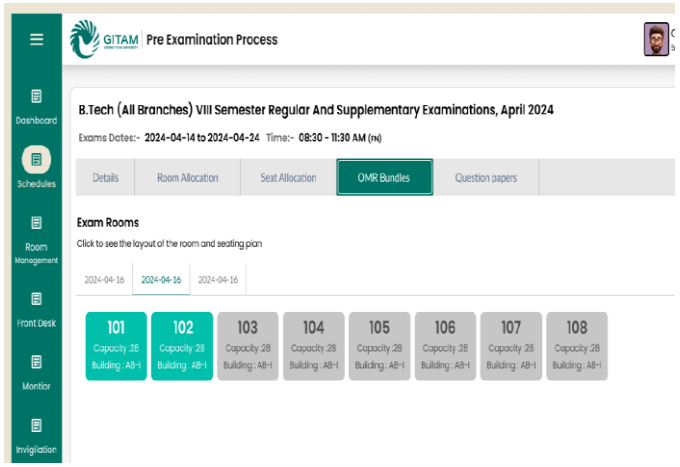

Fig. 5. OMR Bundles in the pre-examination process

Figure 5 shows the OMR Bundles section in the pre-examination process for the B.Tech degree. This section outlines the arrangements for the April 16, 2024, exam room, including the available rooms, their capacities, and relevant building information. The rooms, numbered from 101 to 108, each have a seating capacity of 40 students. Administrators can manage layout and seating planning details.

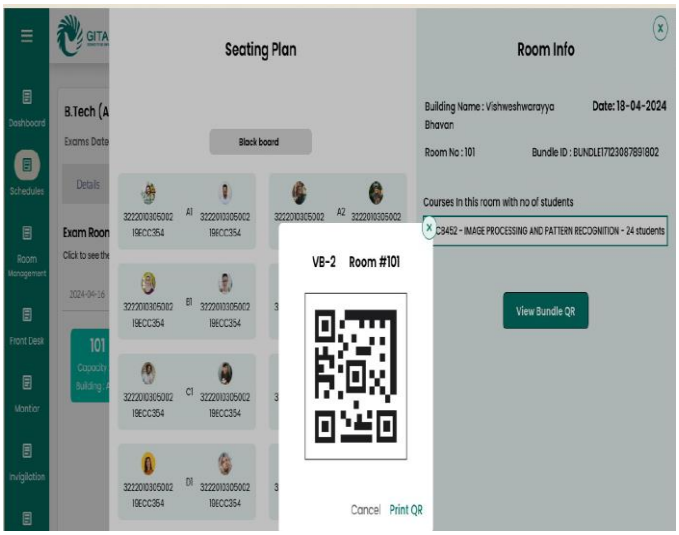

Fig. 6. Seating plan and room information

Figure 6 shows the seating plan and room information for B.Tech degree examinations, specifically for room no 101. The left section explains the seating arrangement with student photos, hall ticket numbers, and allocated seats, such as A1, B1, A2, etc. The QR Code is generated for each room for printing, scanning, and verification purposes.

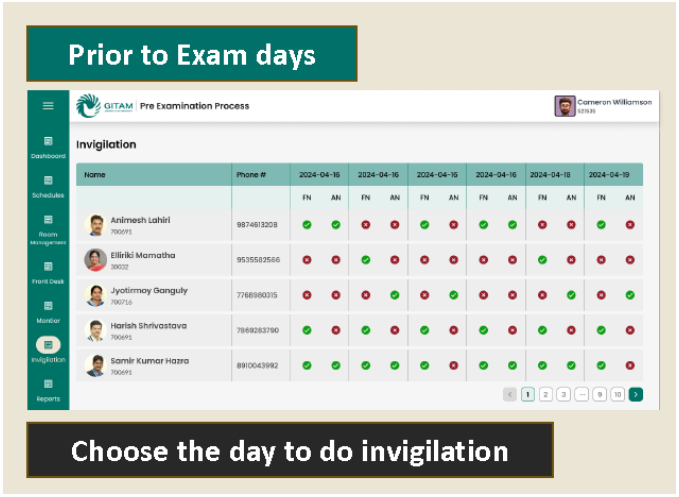

Fig. 7. The invigilation module in the pre-examination process

Figure 7 illustrates the Invigilation module, which enables scheduling of teaching staff for exam invigilation duties. The selection before exam days displays the faculty names and phone numbers, and gives a calendar view from custom dates. Green and red check marks indicate the available slots, and this system enables organised planning and ensures sufficient coverage for all examination sessions.

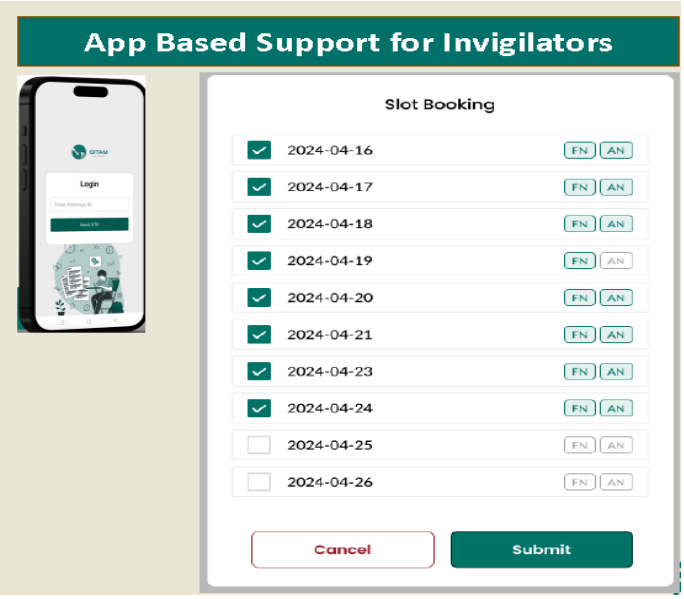

Fig. 8. App-based support for Invigilators

Figure 8 illustrates the app-based support in the GITAM pre-examination process, where the mobile login interface offers different slot bookings for specific dates, such as Forenoon and Afternoon, based on availability. The submit and cancel icons provide final control over confirming or resetting the slots. This app-based interface enables faculty flexibility and improves the overall efficiency of the exam cell department.

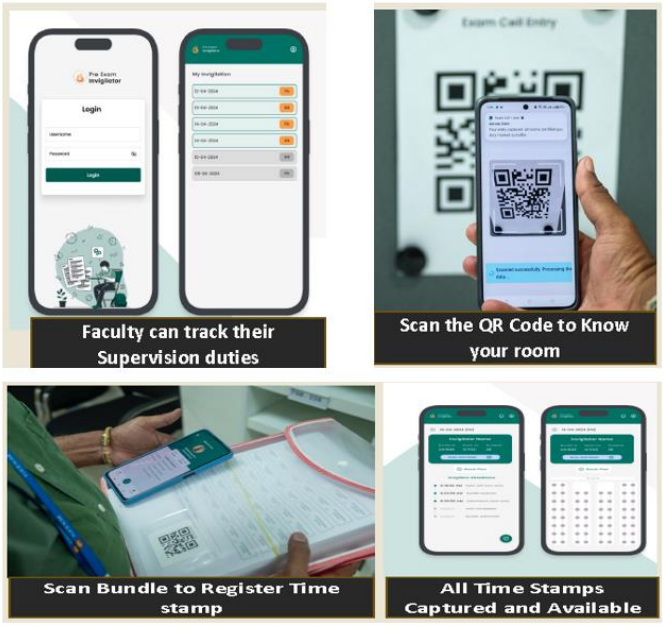

Fig. 9. Comprehensive app-based system for faculty

Figure 9 illustrates the login interface, which faculty can use to access the app and track their duties and schedules. The QR code scanning method enables invigilators to identify the assigned exam room, enhancing accuracy.

The scanning procedure shown in the figure ensures the proper monitoring of exam activities by scanning the bundle, which contains exam materials or attendance sheets. The app can capture and store all timestamps digitally, providing an accessible record of invigilation timings and location identification. Additionally, time tracking is possible within this mobile application.

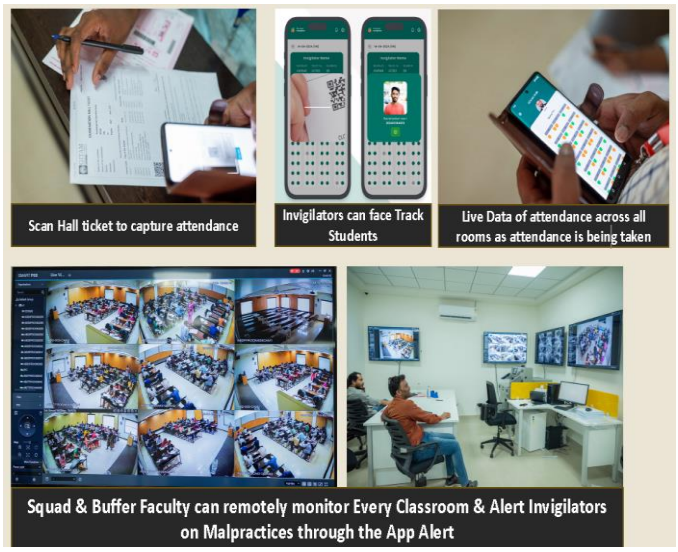

Fig. 10. Digital Invigilation and Attendance Monitoring System

Figure 10 shows the sophisticated digital invigilation and attendance monitoring system. It showcases the application's key functionalities, which scan all hall tickets to record student attendance and track attendance in multiple exam rooms. This tool also enhances the accuracy and efficiency of attendance management. This remote supervision enables the exam cell department to detect and alert the invigilation team, as well as identify any potential malpractice, ensuring the smooth conduct of examinations across all venues.

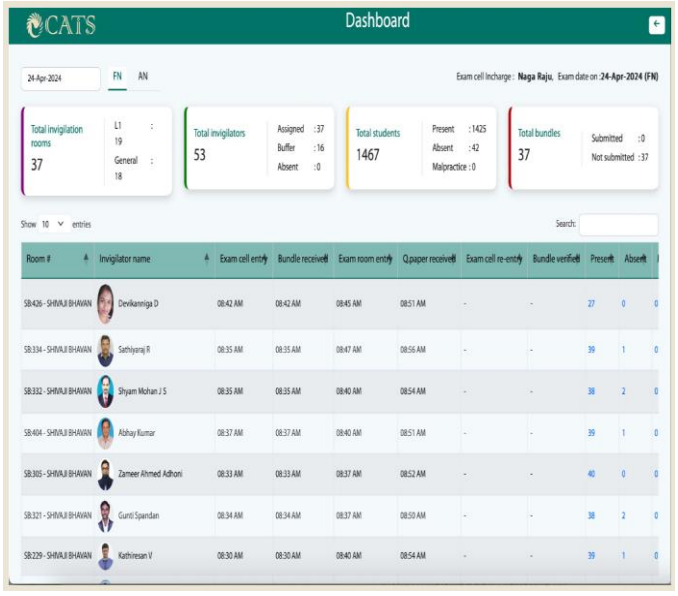

Fig. 11. Dashboard to monitor exam invigilations

Figure 11 shows the dashboard to monitor exam duties and analyse the exam statistics, which includes 37 rooms in L1, L2, General categories and shows total of 1467 students and 53 invigilators are allotted rooms and tracking OMR bundles. This table shows the photos and time stamps for different key exam activities such as cell entry, bundle receipt, and question paper receipt. It also tracks the students present and absent in each room, and real-time monitoring of exams allows smooth coordination and accountability, enabling efficient observation of the operations.

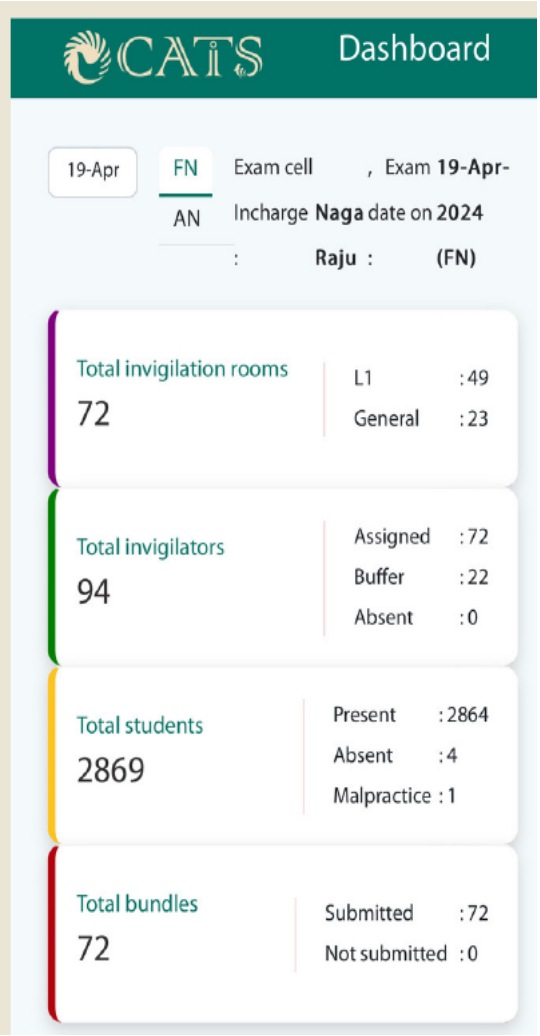

Fig. 12. Deputy Controller dashboard

Figure 12 shows the dashboard summary for exam conduct. It shows 72 invigilation rooms, divided into 49 L1 rooms and 23 general rooms. There are 94 total invigilators assigned, with 72 actively assigned to rooms and 22 on buffer duty, and no absentees. The student count is 2,869, with 2,864 present, four absent, and one reported incident of malpractice. All 72 exam bundles have been submitted, indicating complete and timely collection of examination materials.

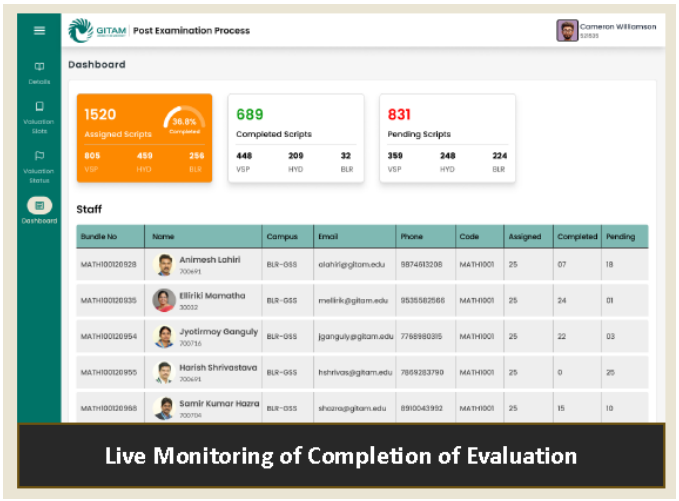

Fig. 13. Live monitoring of the completion of the Evaluation

Figure 13 shows a live monitoring dashboard for completing evaluation scripts within the GITAM Post Examination Process system. Key statistics show 1520 assigned scripts, with 689 completed and 831 pending. It displays data from three campuses, along with respective counts for completed and pending scripts. This system provides real-time transparency and accountability, helping exam coordinators track progress and ensure the timely completion of evaluations.

C. *Examination Day Operations*

- Invigilators received real-time room assignments on the app.
- Student hall tickets were scanned at entry, and anomalies were flagged.
- Live monitoring allowed the exam control room to track attendance across all rooms.

D. *post-examination*

- QR-based answer script return process closed within 15 minutes.
- Digital evaluation slot booking ensured equitable distribution of workload.

V. RESULTS AND DISCUSSIONS

TABLE II
PERFORMANCE METRICS BEFORE AND AFTER REFORMS

Metric	Pre-Reform	Post Reform	Improvement
Manual Interventions	~85% of steps	~25% of steps	-70%
Post-exam closure time	2–3 hours	15 minutes	88% faster
Student complaints	15–20 per cycle	0	100% reduction
Invigilation allocation time	~4 days	<1 day	75% faster

Table II presents various metrics, including student complaints, post-exam closure times, and invigilation allocation times, before and after university reforms. Survey feedback indicated that 92% of students felt the process was more transparent, and 88% of faculty reported reduced administrative burden.

TABLE III
MANUAL VS AUTOMATIC PROCESS

Process	Manual (Pre-Reform)	Automated (Post-Reform)
Seating Allocation	4 days of manual entry, prone to errors	Automated <1 day via algorithm
Answer Script Identification	Handwritten roll numbers, mismatches	Barcode scripts with biometric-secured QP printing
Invigilation Monitoring	Paper-based logs, no real-time updates	Mobile-enabled invigilation with dashboards
Post-exam Closure	2–3 hours manual reconciliation	15 mins automated data sync
Student Communication	Notice boards, crowding	Mobile notification / instant room info
Supervision	15 sessions per semester	Optimised to ~8–10 sessions

Table III presents the manual and automated processes at the university that involve script identification, monitoring of invigilation, and post-exam closure, as well as details on supervision. This project was executed in phases, similar to an industry deployment model. Checks and balances were built through pilot runs, instant feedback loops, and real-time corrections. Phase 1 (April 2024) covered QR-coded scripts, secure printing, and seating automation; Phase 2 will extend predictive analytics and blockchain-based result storage.

CONCLUSION

The digital transformation in the GITAM University examination process has led to improvements in accuracy, and stakeholder satisfaction has resulted in high efficiency across all departments, including teaching, non-teaching, and leadership personnel. Manual interventions were reduced by 70%, and post-exam closure was accelerated from 3 hours to just 10 minutes. This technology has enabled proposed reforms that have made significant changes in the university for faculty members, resulting in a 75% reduction in invigilators' time and a 100% decrease in student complaints. This proposed method demonstrates the adaptation of digital technology for modernising the examination systems in the Bengaluru campus.

FUTURE WORK

The April 2024 reforms at GITAM University's Bengaluru Campus have efficiently transitioned paper-based examinations to a digital format. The university has different plans to incorporate Artificial Intelligence-based predictive scheduling for optimising invigilation, Blockchain integration for immutable record-keeping, and Advanced analytics for forecasting operational bottlenecks.

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