SEBHA UNIVERSITY CONFERENCE PROCEEDINGS, VOL.04 NO. 3 2025
DOI: 10.51984/SUCP.V4I3.4184

وقائع مؤتمرات جامعة سبها
Sebha University Conference Proceedings

Confrence Proceeeding homepage: http://www.sebhau.edu.ly/journal/CAS

# Design and Implementation of a QR-Based Exam Attendance System for Departmental Oversight in Student Information System at Sebha University

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**Keywords:**
Attendance System
QR Code
SIS Integration
Exam Scheduling
CodeIgniter

**A B S T R A C T**

This paper presents the design and implementation of an automated faculty attendance system using QR code technology, integrated with Sebha University's Student Information System (SIS). The system addresses inefficiencies in manual attendance tracking during examinations by leveraging a web-based platform built with PHP and CodeIgniter, along with a MySQL relational database. Key features include real-time QR-based attendance logging for invigilators, automated conflict detection—such as duplicate entries—and seamless integration with exam scheduling data from SIS. Testing demonstrated 100% accuracy in attendance recording, and the system's scalable architecture makes it adaptable for use at other universities.

# تصميم وتنفيذ نظام حضور امتحانات قائم على رمز الاستجابة السريعة (QR) لأغراض الرقابة الإدارية ضمن نظام معلومات الطالب في جامعة سبها

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**الكلمات المفتاحية:**
نظام الحضور
رمز الاستجابة السريعة*(QR)*
تكامل نظام معلومات الطلاب*(SIS)*
جدولة الامتحانات
كودإغنايتر*.(CodeIgniter)*

**الملخص**

يُقدّم هذا البحث تصميم وتنفيذ نظام آلي لتسجيل حضور أعضاء هيئة التدريس باستخدام تقنية رمز الاستجابة السريعة(QR) ، والمُدمج مع نظام معلومات الطلاب (SIS) بجامعة سبها. يُعالج النظام أوجه القصور في تتبع الحضور اليدوي خلال الامتحانات من خلال الاعتماد على منصة إلكترونية تعتمد على الويب) بلغة PHP وإطار (CodeIgniterوقواعد بيانات علائقية .(MySQL) تشمل الميزات الأساسية للنظام تسجيل الحضور الفوري باستخدام QR للمراقبين، والكشف التلقائي عن التعارضات مثل الإدخالات المكررة، والتكامل السلس مع بيانات جدول الامتحانات المستخرجة من نظام .SIS أظهرت نتائج الاختبار دقة بنسبة 100% في تسجيل الحضور، كما يتميز النظام ببنية قابلة للتوسع تجعله مناسبًا للتطبيق في جامعات أخرى.

## 1. Introduction

The organization and supervision of final examinations in higher education institutions present growing administrative challenges, particularly regarding the documentation of attendance and departure times for faculty members and invigilators. At Sebha University, the absence of an electronic mechanism within the Student Information System (SIS) [1-3]to monitor and track the commitment of invigilation staff has highlighted a critical administrative gap. This lack of automation hinders operational efficiency and places a significant burden on exam committees and department heads responsible for monitoring staff punctuality and engagement during exam sessions.

To address this gap, this study proposes the design and implementation of an integrated Final Exam Scheduling Management System that leverages QR code technology to record the real-time attendance and departure of faculty members assigned to invigilate final exams. The system aims to provide department heads with accurate and immediate data on attendance behavior, ensuring higher levels of academic governance and organizational discipline.

Previous studies have demonstrated the value of integrating smart technologies in attendance monitoring. For example, Vijayakumar et al.[4] developed an automated student attendance tracking system for end-semester examinations using face recognition technology, significantly reducing fraud and ensuring accurate verification. Similarly, Zhuang and Huang [5] designed an intelligent classroom attendance system based on image recognition, showcasing the capabilities of artificial intelligence in educational monitoring.

QR code–based attendance systems have also proven to be cost-effective and efficient solutions. Reddy et al. [6]and Nuhi et al. [7]implemented QR-based smart attendance systems that generated

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*Article History : Received 20 February 2025 - Received in revised form 01 September 2025 - Accepted 07 October 2025*

personalized QR codes for each user, improving recording accuracy and reducing administrative complexity—particularly in institutions with limited technical infrastructure.

Additionally, prior research has emphasized the impact of such systems on educational quality and human resource management. Durak et al.[8]highlighted the pedagogical and communicative uses of QR codes in education, while Arif et al. [9] conducted a critical review of attendance management systems, underscoring the need for adopting modern technologies such as biometrics, QR, and Wi-Fi-based tracking.

In a more recent review, Alagasan et al. [10]affirmed the effectiveness of smart attendance systems in enhancing transparency and reducing operational costs in academic institutions.

In response to the administrative challenges facing Sebha University—particularly the lack of an integrated mechanism within the current Student Information System (SIS) to monitor faculty attendance during final examinations—this research proposes the development of an automated QR-based attendance system for invigilation tracking. Rooted in the need to enhance academic discipline, transparency, and operational efficiency, the proposed system aims to provide a real-time, reliable method for recording the presence and exit of faculty members involved in exam supervision.

Supported by prior studies that have demonstrated the effectiveness of smart attendance systems using facial recognition, image processing, Wi-Fi networks, and QR codes [4, 5], [6], this study seeks to introduce a solution that is not only technically feasible but also aligned with modern educational technology trends.

By integrating seamlessly with SIS and providing decision-makers—such as department heads and exam supervisors—with accurate and timely data, the system will enable proactive monitoring of staff compliance and improve the overall governance of the examination process. Ultimately, this work contributes to the digital transformation of educational administration in Libyan universities and serves as a scalable model for similar institutions.

## 2. System Architecture / Design

The system is designed to streamline exam management by empowering the parent department to handle scheduling, invigilation, and attendance tracking for its courses. This structure ensures centralized control, where the department sets exam dates, assigns faculty, selects venues, and manages attendance, even for faculty-wide shared courses. The design includes four key tables (Tables 1 and 2) to support these workflows:

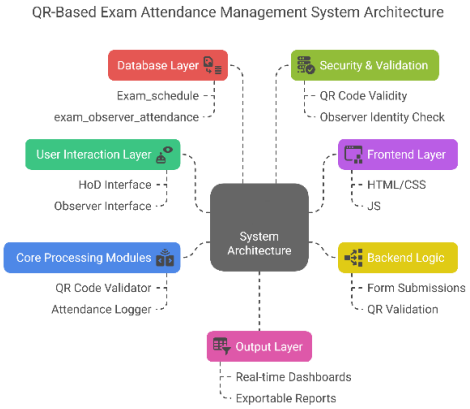



**Figure. 1:** System Architecture

### a. Schedule Table

**Table 1.** Exam schedule

| Column | Type | Null | Default |
|---|---|---|---|
| **ID** | **Int** | **No** | |
| **exam_code** | **varchar(50)** | **Yes** | **NULL** |
| **faculty_ID** | **Int** | **No** | |
| **dpt_ID** | **Int** | **No** | |
| **faculty_ID_location** | **Int** | **No** | |
| **crs_ID** | **varchar(50)** | **No** | |
| **season_ID** | **Int** | **No** | |
| **exam_day** | **varchar(15)** | **No** | |
| **exam_date** | **Date** | **No** | |
| **exam_time** | **Time** | **No** | |
| **room_no** | **varchar(10)** | **No** | |
| **QR_code** | **Bigint** | **No** | **0** |
| **duration** | **varchar(50)** | **No** | |
| **Valid** | **Int** | **No** | **0** |

### b. QR Attendance & Attendance Assignment Table

**Table 2. :**Examobserver of attendance.

| Column | Type | Null | Default |
|---|---|---|---|
| **exam_ID** | **Bigint** | **No** | |
| **exam_code** | **Int** | **No** | |
| **personal_ID** | **varchar(50)** | **No** | |
| **check_in_time** | **time** | **No** | |
| **check_out_time** | **time** | **No** | |
| **Valid** | **Int** | **No** | **0** |

The new module will introduce two primary tables (Exam_schedule and exam_ observer _attendance as described above) and leverage these existing tables: -

**Table 3.**: Stricture Of System Data Base

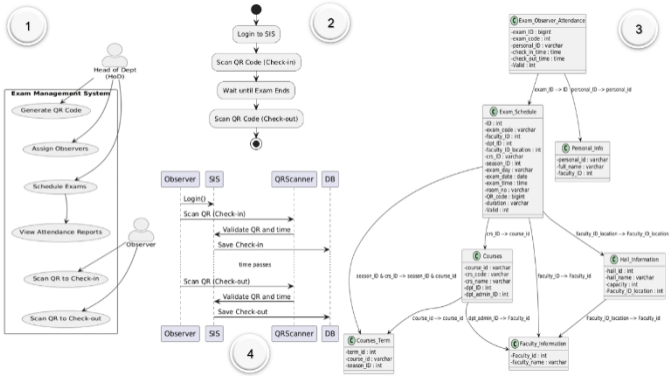
| Table | Key Columns Used | Purpose of the Exam Attendance Module |
|---|---|---|
| Personal_info | **personal_id, full_name, faculty_ID** | **Verify the name of the observer and their eligibility to be assigned as an observer of the exam.** |
| Courses | **course_id, crs_code, crs_name, dpt_ID, dpt_admin_ID** | **The information about the Exam includes the course code, the course name, and the department that administers the course.** |
| Courses_term | **term_id, course_id, season_ID** | **Confirm exam scheduling per term.** |
| Hall_information | **hall_id, hall_name, capacity, Faculty_ID_location** | **Assign seating and track hall utilization.** |
| Faculty_information | **Faculty_id, faculty_name** | **Identify invigilators (exam supervisors).** |

The exam attendance module relies on several interconnected tables to manage and verify key aspects of the examination process.

The Personal_information table contains fields such as personal_id, full_name, and faculty_ID, which are used to verify the identity and eligibility of personnel assigned as exam observers. The Courses table provides essential exam-related details, including course_id, crs_code, crs_name, dpt_ID, and dpt_admin_ID, capturing the course's identity and the responsible department. The Courses_term table uses term_id, course_id, and season_ID to validate the scheduling of exams within specific academic terms.

The Hall_information table, consisting of hall_id, hall_name, capacity, and Faculty_ID_location, facilitates hall assignment and monitors seating capacity and usage. Lastly, the Faculty_information table, with Faculty_id and faculty_name, is used to identify and assign qualified invigilators to supervise the exams. Together, these tables support a comprehensive and coordinated approach to managing university exam attendance.

## 3. Functionality




- **Head of Department**:
  - View current semester schedule
  - Assign observers to exams

In the system, the administrator department sets the exam schedules for the courses it manages, including their availability in the semester and their assignment to faculty members. The university's Student Information System relies on the department to manage courses, where some courses may be shared

across the faculties but are administratively assigned to a specific department.

This department is responsible for scheduling exams for its courses and assigning invigilators to each exam. Invigilators can be any entity in the system except students, such as faculty members, staff, or teaching assistants, provided they belong to the faculty overseeing the exam.

Additionally, HoD is responsible for maintaining attendance records. When adding an exam for the current semester, HoD specifies:

- The exam date.
- The exam duration (e.g., 120 minutes).
- The exam hall.

Since exams can be held anywhere across the university campus (in any faculty), the department head selects the faculty where the exam will take place and then assigns a specific hall.

After adding the exam, the department head prints a QR code for check-in and check-out, which invigilators use to confirm their attendance.

The system enforces certain **restrictions**:

- An exam cannot be added more than once.
- Attendance registration is only allowed during the predefined exam time.

- **Observer (Staff)**:

On the observer's side, three actions are needed: -

  - Login to SIS
  - Scan a QR code to check-in before the exam
  - Scan another QR to check-out after the exam

**Technologies:**

- Back-end:

The back-end consists of two main components: MySQL is used to manage the database, ensuring reliable storage and retrieval of student-related data, while PHP serves as the server-side scripting language responsible for programming the application's logic, handling user interactions, and communicating with the database.

MySQL: MySQL is an open-source relational database management system (RDBMS) that uses Structured Query Language (SQL) to store, manage, and retrieve structured data efficiently. In this system, MySQL version 8.0.41is used in conjunction with phpMyAdmin as the database management interface, aligning with the existing Student Information System (SIS) infrastructure, which already operates on this platform. This setup ensures compatibility, ease of integration, and centralized data handling for student-related operations.

PHP:This system utilizes PHP version 8.3.22, a modern server-side scripting language primarily used for web development and backend processing. It introduces enhanced performance, improved error handling, and greater type safety, making it more robust and efficient than previous versions.

Frontend: Web Interface

- QR: Generated per session, verified by system time

**5. Security and Validation**

- QR code is valid only for a specific time window
- System prevents multiple logins or proxy attendance
- Logs every attempt with timestamp

**6. Benefits**

- Accurate tracking of exam staff
- Real-time visibility for management

**4. Finding and Results**

The implementation of the QR-based Exam Attendance System at Sebha University has significantly improved the efficiency, accuracy, and oversight of exam attendance tracking. The system integrates seamlessly with the existing Student Information System (SIS), providing departmental heads with powerful tools to manage exam schedules, assign observers, and generate detailed attendance reports. Below are the key findings and results derived from the system's deployment:

System Exam Information Input by Head of Department (Figure 2)

Finding: The system enables the Head of Department to enter comprehensive exam details, including the course name, course code, academic year, and relevant college/department information. For instance, Figure 2 documents the exam information for the course "أمن الحواسيب" (Computer Security) with the code IT500, offered in the Spring 2024/2025 semester under the College of Information Technology.


**Figure. 2:** Interface ofthe System Input

Result: This centralized data entry process ensures consistency and clarity in exam-related information, minimizing administrative errors and facilitating easy access for all stakeholders, including faculty, observers, and students.


**Figure. 3:** Form ofFinal Exam Information

Final Exam Timetable for All Courses (Figure 4)

Finding: The system generates a comprehensive final exam timetable, as illustrated in Figure 4. The timetable includes essential details such as course names, exam duration (in minutes), exam day, time, and the corresponding college or department. For example, several courses are scheduled on Mondays at 11:00 AM, each with a duration of 120 minutes.

Result: The automated scheduling process eliminates conflicts and ensures an even distribution of exams. It also provides students and faculty with a clear and organized overview, significantly enhancing administrative efficiency and exam coordination.

**Figure. 4:** Final Exam Timetable for All Courses

Observer Assignment by Head of Department (Figure 5)

Finding: The Head of Department can assign observers to each exam

directly through the system. Figure 5 displays the list of assigned observers for the Computer Security exam, including their names and roles.

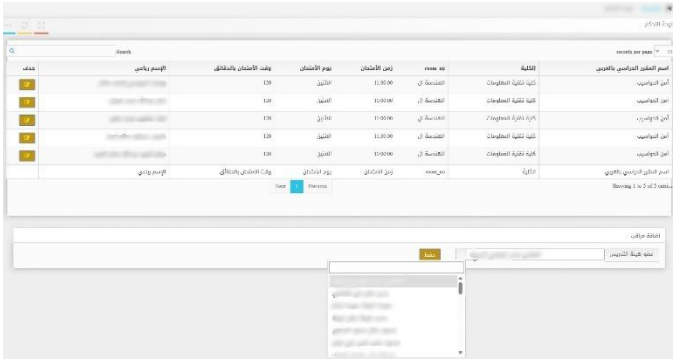


**Figure. 5:**Observer Assignment by Head of Department

Result: This feature streamlines the invigilation process by ensuring that each exam is supervised by designated and authorized personnel. It also enhances accountability and transparency in the administration of exams.

Exam Attendance Tracking and Reporting (Figure 6)

Finding: The system captures real-time attendance data using QR codes, as demonstrated in Figure6. The report includes details such as staff member names, course codes, exam dates, arrival times, and departure times (if recorded). For example, staff member XX attended the IT500 exam on 2025-06-30, with the arrival time logged as 00:00:00 (a placeholder for the actual time).

**جامعة سبها**

كلية تقنية معلومات

تقرير حضور الامتحانات النهائية علوم الحاسب

| الحالة | زمن الانصراف | زمن الحضور | تاريخ الحضور | الاسم | اسم المقرر | رمز المقرر |
|---|---|---|---|---|---|---|
| ..... | 00:00:00 | 00:00:00 | 2025-07-02 | | نظم التشغيل | IT604 |
| ..... | 00:00:00 | 00:00:00 | 2025-06-17 | | اساسيات برمجة | GS101 |
| ..... | 00:00:00 | 00:00:00 | 2025-06-29 | | الحوسبة السحابية | IT705 |
| ..... | 00:00:00 | 00:00:00 | 2025-06-25 | | النظم الخبيرة | CS809 |
| ..... | 00:00:00 | 00:00:00 | 2025-06-25 | | بناء المترجمات | CS701 |
| ..... | 00:00:00 | 00:00:00 | 2025-06-23 | | خوارزميات& هياكل بيانات متقدمة | CS503 |
| ..... | 00:00:00 | 00:00:00 | 2025-06-23 | | ذكاء اصطناعي | IT704 |
| ..... | 00:00:00 | 00:00:00 | 2025-07-02 | | نظم التشغيل | IT604 |
| ..... | 00:00:00 | 00:00:00 | 2025-06-17 | | اساسيات برمجة | GS101 |
| ..... | 00:00:00 | 00:00:00 | 2025-06-30 | | أمن الحواسيب | IT500 |
| ..... | 00:00:00 | 00:00:00 | 2025-06-25 | | النظم الخبيرة | CS809 |
| ..... | 00:00:00 | 00:00:00 | 2025-06-25 | | بناء المترجمات | CS701 |
| ..... | 00:00:00 | 00:00:00 | 2025-06-21 | | تنقيب البيانات | IT801 |
| ..... | 00:00:00 | 00:00:00 | 2025-06-23 | | خوارزميات& هياكل بيانات متقدمة | CS503 |
| ..... | 00:00:00 | 00:00:00 | 2025-06-23 | | ذكاء اصطناعي | IT704 |

**Figure. 6:** Final Report of Staff Exam Attendance

Result: The QR-based system minimizes manual entry errors and accelerates the attendance tracking process. Automated report generation provides actionable insights for departmental oversight, enabling the identification of trends such as absenteeism or reporting inconsistencies.

The results confirm that the QR-Based Exam Attendance System effectively addresses the challenges of departmental oversight in exam management at Sebha University, aligning with the goals of modernizing academic administration through technology.

## 5. Future Work

Future work will focus on expanding the QR-based system to cover regular class attendance for both students and staff. This includes integrating class schedules and enabling real-time QR check-ins to prevent proxy attendance. The system will generate detailed reports to support academic monitoring and performance evaluation. Automated alerts for repeated absences will be introduced to support early intervention. The platform will be optimized for scalability and mobile use. This development aims to improve transparency, accountability, and data-driven decision-making. Ultimately, it will offer a unified solution for managing both exams and daily attendance.

## 6. Conclusion

The design and implementation of the QR-based Exam Attendance System at Sebha University represent a significant step toward modernizing and automating exam administration. By seamlessly integrating with the existing Student Information System (SIS), the system improves the accuracy, efficiency, and transparency of attendance tracking and reporting. It equips departmental leadership with real-time data and tools to manage exam logistics, observer assignments, and attendance verification effectively. The success of this initiative highlights the potential of simple, scalable technologies to enhance academic oversight and streamline operational workflows. As the system expands to include class attendance tracking for both students and faculty, it is poised to become a comprehensive solution—supporting broader institutional goals of accountability and academic quality assurance.

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