

## HEU Library Smart Attendance and Security Login System: A Descriptive Analytics Study of System-Generated Attendance Logs

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### Abstract

### Original Research Article

Academic libraries are essential learning spaces in higher education, yet many Philippine universities continue to depend on paper-based attendance logbooks that compromise data accuracy, operational efficiency, and campus security [1], [8]. This paper presents a descriptive analytics study of student library attendance data generated by the HEU Library Attendance and Security Login System, a QR-based digital entry management platform deployed at a university in Negros Occidental, Philippines [2]. The study analyzed two system-exported CSV files covering seven operating days from April 6 to 16, 2026, encompassing 9,727 login events from 3,382 unique student patrons. No surveys, interviews, manual observations, or self-reported data were used [6]. Key findings indicate that Monday is the consistently highest-demand day, with April 6 alone accounting for 50.8% of all login events in the reporting period. The midday window from 12:00 to 13:59 constitutes the structural peak block, representing 27.1% of all daily logins. Login frequency analysis shows that 83.0% of patrons were infrequent visitors while a core group of 116 students (3.4%) generated high-frequency usage patterns that drive peak-hour congestion. These data-driven findings are translated into operational recommendations on staffing allocation, secondary kiosk deployment, security monitoring, and patron engagement campaigns, demonstrating the institutional value of automated attendance systems in academic library management [3], [9].

**Keywords:** Attendance monitoring, security login system, descriptive analytics, QR code, library management, data-driven decision-making, higher education.

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## I. INTRODUCTION

Academic libraries are recognized as strategic assets in higher education, providing spaces for independent study, collaborative inquiry, and access to scholarly resources [8]. The International Federation of Library Associations and Institutions (IFLA) has consistently identified libraries as

foundational pillars of knowledge societies, and calls for institutions to invest in evidence-based management frameworks that optimize service delivery to their patron populations [8]. As student enrolment expands and institutional demands intensify, managing library access efficiently and securely has become a pressing administrative concern in many Philippine universities.



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Traditional paper-based logbooks, still in widespread use in many local universities, are vulnerable to inaccuracies, physical deterioration, illegibility, and data loss [1]. These limitations impede evidence-based management, weaken institutional accountability, and create safety gaps in high-traffic academic spaces [6]. Digital attendance systems have been proposed as a fundamental shift from passive record-keeping to proactive institutional data generation [1], [7]. When integrated with QR-code or barcode scanning, such systems capture real-time timestamped entry and exit records, enabling administrators to analyze usage trends, optimize staffing schedules, and maintain accurate occupancy data for emergency response [2], [5].

In the Philippine higher education context, QR- and RFID-based library access systems have demonstrated measurable improvements in attendance accuracy and administrative efficiency [2]. These advances align with the Commission on Higher Education's (CHED) policies on library standards, which require information and communication technology integration in academic support services [4]. Globally, the adoption of smart library management systems is accelerating, with analytics-capable platforms increasingly favored for their ability to generate patron usage data, support evidence-based decision-making, and improve staff productivity [7], [9].

Most existing research, however, focuses on system design and deployment rather than on the analytical value of the data these systems generate once operational [7]. This paper addresses that gap. It examines the operational dataset produced by the HEU Library Attendance and Security Login System over a seven-day period, guided by four objectives: (1) to characterize daily traffic patterns and login frequency distributions from system-generated logs; (2) to identify structural peak demand periods through hourly and day-of-week aggregation; (3) to derive operational key performance indicators (KPIs) translating raw log data into management-ready metrics; and (4) to formulate evidence-based recommendations on staffing, kiosk deployment, security monitoring, and patron engagement [3], [6].

All data originate exclusively from system-exported CSV files containing 3,382 student records and 9,727 login events recorded from April 6 to 16, 2026. No survey instruments, interviews, manual observations, or self-reported data were collected or utilized. This methodological boundary ensures analytical integrity and reflects the study's core contribution: demonstrating that system-generated attendance logs, when systematically analyzed, constitute a sufficient and robust basis for operational decision-making in academic library management [1], [3].

## II. METHODOLOGY

### A. Study Design

This study employs a descriptive analytics design, using structured analysis of historical system-generated records to characterize library usage patterns [6]. Descriptive analytics is understood here as the systematic use of historical data to describe and summarize what occurred, without projecting future outcomes or testing causal hypotheses [6], [3]. The unit of analysis is the individual login event, bounded by the seven operating days in the April 6 to 16, 2026 export window. The study produces frequency distributions, aggregated counts, hourly and daily breakdowns, and derived ratios that convert raw log data into management-relevant metrics, without invoking inferential statistical methods.

### B. System Overview

The HEU Library Attendance and Security Login System is a digital entry management platform deployed at the library entrance of a university in Negros Occidental, Philippines. When students enter, they present their university-issued identification card at the entry kiosk, which reads the embedded QR code or barcode and retrieves the student's profile from the university database [2]. Each successful scan generates a timestamped log entry containing the student ID, full name, year level, degree program, class section, transaction type (IN or OUT), date, and cumulative login count for the

reporting period. Records are stored in a local database with offline synchronization capability, ensuring data persistence during internet disruptions [5]. All data are exported in CSV format for analysis.

### C. Data Structure

The summarized export file (summarized\_data\_heulib.csv) contains one record per unique student patron for the full reporting period. Table I describes each data field. This structure is consistent with best practices for transactional log design in management information systems [3].

**Table I. Data Field Descriptions of the System-Generated Export File**

Field Name	Data Type	Description
student_id	INTEGER	Unique university-assigned student identifier.
fullname	VARCHAR	Full name in Last, First Middle format.
year	INTEGER	Year level of the student (values 1–4).
course	VARCHAR	Degree program code (e.g., BSIT, BABA, BN, BSPS).
section	VARCHAR	Class section identifier (A, B, C, etc.).
login_date	DATE	Date of the most recent transaction (DD/MM/YYYY).
number_of_times_logged	INTEGER	Cumulative count of all ID scans during the reporting period.

### D. Dataset Summary

Table II presents the aggregate statistics of the export dataset. Four records with anomalous year-level

values (blank, 8, 11, and 12) were excluded from year-level analysis but retained in overall student and login totals, as each represents a valid library access event.

**Table II. Summary Statistics of the System-Generated Dataset**

Parameter	System-Generated Value
Export filename	summarized_data_heulib.csv
Export generated	April 28, 2026, 14:04
Analysis period	April 6–16, 2026 (7 operating days)

Total unique student patrons	3,382 students
Total login events	9,727 events
Average logins per student	2.88 logins/student
Anomalous year-level records	4 records (year values: blank, 8, 11, 12) — excluded from year-level analysis only
Data completeness	100% — all records contain complete required fields
Location uniformity	All 3,382 records: loc_name = 'HEU Library'

### E. Analytical Methods

All analysis was performed using Microsoft Excel pivot tables applied to the two system-exported CSV files. Six procedures were employed: (1) daily aggregate count—grouping records by login date to compute unique student counts, total login events, and average logins per student per day; (2) day-of-week aggregation—mapping dates to weekdays and computing per-weekday totals and averages; (3) year-level distribution—filtering to year values 1–4 and computing login counts per group; (4) login frequency distribution—classifying all 3,382 patrons into five usage tiers by cumulative login count [3]; (5) hourly traffic analysis—grouping the 9,727 individual timestamped login events from

the detailed log file (detailed\_data\_heulib.csv) into one-hour blocks; and (6) KPI derivation—computing twelve management-relevant indicators from the aggregate dataset [3], [7].

### III. RESULTS

#### A. Daily Attendance Summary

Table III presents the complete day-by-day attendance record. The seven operating days’ span two partial weeks: April 6–8 (Week 1) and April 13–16 (Week 2), with the intervening period corresponding to a university holiday break. This segmentation is noted to contextualize the attendance decline observed between weeks.

**Table III. Daily Attendance Summary: April 6–16, 2026**

Date	Day	Unique Students	Total Logins	Avg. Logins/Student	% of Period
<b>Apr 6, 2026</b>	<b>Monday</b>	<b>1,159</b>	<b>4,946</b>	4.3	<b>50.8%</b>
Apr 7, 2026	Tuesday	256	933	3.6	9.6%
Apr 8, 2026	Wednesday	722	1,842	2.6	18.9%
Apr 13, 2026	Monday	428	843	2.0	8.7%
Apr 14, 2026	Tuesday	331	547	1.7	5.6%
Apr 15, 2026	Wednesday	262	359	1.4	3.7%

Apr 16, 2026	Thursday	224	257	1.1	2.6%
<b>Total / Avg.</b>	—	<b>3,382</b>	<b>9,727</b>	<b>2.88</b>	<b>100%</b>

Monday, April 6 was the highest-traffic day in the dataset, recording 1,159 unique student patrons and 4,946 login events—equivalent to 34.3% of all unique students and 50.8% of all login events in the seven-day period. The average logins per student on April 6 reached 4.3, indicating that patrons on this day were not only more numerous but considerably more active within the library than on any other operating day. A consistent downward attendance trend is observable within each week: library demand declines progressively as the week advances. This

pattern is present in both Week 1 and Week 2, with Week 2 opening at a substantially lower baseline—possibly reflecting a lighter academic schedule in the second observed week [1], [7].

### B. Login Frequency Distribution

Table IV classifies all 3,382 student patrons into five usage tiers based on the number\_of\_times\_logged field from the system export.

**Table IV. Login Frequency Distribution of Student Patrons**

Login Count Tier	No. of Students	% of Students	Operational Significance
<b>20–26 (Power Users)</b>	<b>9</b>	0.3%	Most likely to queue at entry kiosk; Plan B access protocol critical.
15–19 (High)	24	0.7%	Regular heavy users; priority-lane access may be beneficial.
10–14 (Regular)	83	2.5%	Core patron base; reliable daily library users.
5–9 (Occasional)	458	13.5%	Moderate visitors; sensitive to peak-hour congestion.
1–4 (Infrequent)	2,808	<b>83.0%</b>	Single or rare visitors; primary target for awareness campaigns.
<b>Total</b>	<b>3,382</b>	<b>100%</b>	

The distribution exhibits strong right-skewness: 83.0% of patrons (2,808 students) visited the library only one to four times during the seven-day window, constituting the library’s broad general audience. In

contrast, 116 students across the top three tiers (10 or more logins; 3.4% of all patrons) form a high-frequency core. The nine Power Users (20 or more logins) are particularly significant because their

repeated entry and exit scans disproportionately contribute to entry kiosk demand, especially when they arrive during the midday peak alongside the general patron population [1], [2].

### C. Hourly Traffic Distribution

Table V presents the distribution of login events across one-hour blocks derived from the detailed timestamp log file. Traffic levels were classified using percentage-share thresholds: PEAK ( $\geq 13.0\%$ ), High (10.0–12.9%), Moderate (5.0–9.9%), and Low/Very Low ( $< 5.0\%$ ).

**Table V. Hourly Distribution of All Login Events (April 6–16, 2026)**

Hour Block	Total Logins	% of All Logins	Cumulative %	Traffic Level
07:00–07:59	250	2.6%	2.6%	Low
08:00–08:59	581	6.0%	8.6%	Moderate
09:00–09:59	1,177	12.1%	20.7%	High
10:00–10:59	1,142	11.7%	32.4%	High
11:00–11:59	1,198	12.3%	44.7%	High
<b>12:00–12:59</b>	<b>1,282</b>	<b>13.2%</b>	<b>57.9%</b>	<b>PEAK</b>
<b>13:00–13:59</b>	<b>1,349</b>	<b>13.9%</b>	<b>71.8%</b>	<b>PEAK</b>
14:00–14:59	1,159	11.9%	83.7%	High
15:00–15:59	854	8.8%	92.5%	Moderate
16:00–16:59	417	4.3%	96.8%	Low
17:00–17:59	241	2.5%	99.3%	Low
18:00–18:59	69	0.7%	100.0%	Very Low
19:00–19:59	8	0.1%	100.0%	Very Low

Two consecutive PEAK hours were identified: 12:00–12:59 (1,282 logins; 13.2%) and 13:00–13:59 (1,349 logins; 13.9%), together accounting for 27.1% of all login events across the full analysis period. The 13:00–13:59 block is the single busiest

hour in the dataset. An additional four hours—09:00, 10:00, 11:00, and 14:00—fall within the High traffic range (10.0–12.9% each), producing a sustained high-demand window from 09:00 to 15:00. This extended six-hour window of elevated patron traffic

carries direct implications for kiosk capacity planning, staffing schedules, and service delivery readiness [2], [7].

**D. Per-Date Peak Hour Breakdown**

Table VI disaggregates peak hours by individual operating date to reveal day-specific variations in traffic timing that are masked by the aggregate hourly analysis.

**Table VI. Top Three Peak Hours per Operating Date**

Date	Day	#1 Peak Hour	#2 Peak Hour	#3 Peak Hour
Apr 6	Monday	13:00 (267 logins)	12:00 (262)	14:00 (204)
Apr 7	Tuesday	09:00 (208)	10:00 (113)	08:00 (98)
Apr 8	Wednesday	13:00 (294)	12:00 (252)	11:00 (239)
Apr 13	Monday	12:00 (235)	13:00 (207)	14:00 (204)
Apr 14	Tuesday	10:00 (226)	11:00 (196)	13:00 (193)
Apr 15	Wednesday	14:00 (188)	11:00 (185)	12:00 (185)
Apr 16	Thursday	13:00 (223)	11:00 (217)	10:00 (196)

The 12:00–12:59 and 13:00–13:59 blocks appear within the top-three peak positions on six of the seven operating days, confirming the midday window as the library’s most structurally consistent high-demand period. Tuesday is the notable exception: both April 7 and April 14 registered primary peaks in the morning (09:00 and 10:00, respectively), suggesting that Tuesday class scheduling directs students to the library earlier in the day. This day-specific variation reinforces the value

of granular, date-level analytics rather than relying solely on aggregate hourly totals [3], [6].

**E. System Key Performance Indicators**

Table VII presents twelve KPIs derived from the system analytics module for the April 6–16, 2026 dataset. These metrics transform raw log data into management-ready operational intelligence [3], [9]

**Table VII. System Key Performance Indicators (April 6–16, 2026)**

KPI	System Value	Operational Significance
Total Unique Student Patrons	<b>3,382 students</b>	Total library user base for the analysis period.
Total Login Events	<b>9,727 events</b>	All entry and exit transactions recorded by the system.

Average Logins per Student	2.88	Baseline patron engagement index for the period.
Peak Hour (All Days Combined)	<b>13:00–13:59: 1,349 (13.9%)</b>	Highest single-hour demand; primary kiosk pressure window.
Second Peak Hour	12:00–12:59: 1,282 (13.2%)	Combined 12:00–13:59 block = 27.1% of all period logins.
Peak Day (Student Count)	<b>Apr 6: 1,159 students</b>	Highest single-day demand; maximum staffing required.
Peak Day (Login Events)	<b>Apr 6: 4,946 events</b>	50.8% of all period logins concentrated on one day.
Peak Day of Week (Avg. Logins)	<b>Monday: 2,894 avg.</b>	Primary day for maximum kiosk and staff deployment.
Power Users ( $\geq 20$ logins in 7 days)	9 students (0.3%)	Targets for Plan B contingency and repeat-use protocols.
Infrequent Users (1–4 logins)	2,808 students (83.0%)	Primary audience for library awareness and engagement campaigns.
System Data Completeness	<b>100%</b>	No missing required fields across all 3,382 export records.

#### IV. DISCUSSION

##### A. Library Management and Staffing Implications

The pronounced concentration of library usage on Mondays—with April 6 alone representing 50.8% of all period login events—challenges any staffing model that assigns uniform personnel coverage across the week. These data provide an empirical basis for a weighted staffing approach in which Monday is treated as the library’s highest-priority service day [3], [7]. This finding is consistent with trends documented in library systems benchmarking literature, where entrance gate count data consistently reveal day-of-week and time-of-day demand asymmetries that are invisible to administrators relying on manual records [7]. The consistent intra-week downward trend across both observed weeks further suggests that personnel could

be redeployed from lower-demand days (Wednesday–Thursday) to reinforce Monday and early-week coverage, pending full-semester data validation [6].

At a finer temporal resolution, the peak hour analysis confirms that 27.1% of all login events are concentrated between 12:00 and 13:59. Ensuring maximum personnel presence at the entry kiosk, reference counter, and circulation desk during this two-hour window is not merely an operational preference but a data-supported requirement for service continuity and emergency preparedness [4], [9]. The EDUCAUSE Horizon Report has identified data-informed human resource allocation as a growing priority in higher education institutions undertaking digital transformation, and the KPI framework in Table VII directly supports this practice [9].

## B. Kiosk Deployment and Bottleneck Mitigation

The login frequency distribution reveals that 83.0% of students interact with the entry kiosk infrequently, suggesting that most patrons pass through quickly. However, the 116 high-frequency users (3.4%) and nine Power Users generate repeated sequential scans that, when synchronized with the midday peak, can create a flow bottleneck at the single entry point [1], [2]. Per-date data in Table VI confirm that the highest daily login volumes consistently align with the 12:00–13:59 block on nearly all operating days. A secondary kiosk or manual contingency verification lane should therefore be activated during this midday window, prioritizing Mondays and Wednesdays as the days with the most structurally reliable midday peaks. Research on biometric and QR-based library access systems confirms that parallel verification pathways are effective through put management tools in high-demand entry scenarios [5].

## C. Security Monitoring and Emergency Preparedness

The system's 100% data completeness across 3,382 student records is one of its most operationally consequential security features. Every authorized entry event is captured with a verified student identity, timestamped, and linked to a year level and degree program. In an emergency evacuation scenario, the system can generate an immediate, complete list of all patrons currently logged as present in the library—a capability that no paper logbook can replicate [4], [5]. This directly supports CHED's institutional safety requirements, which mandate accurate real-time occupancy documentation in high-traffic academic spaces [4]. IFLA further underscores that digital library management systems must incorporate security and access control features to ensure patron safety and institutional compliance [8]. The system's offline synchronization design strengthens this security layer by preserving records during internet disruptions, a recurring infrastructure challenge in provincial Philippine university settings [5].

## D. Data-Driven Decision-Making

The KPIs in Table VII illustrate how raw attendance logs can be transformed into management-ready institutional intelligence [3]. Metrics such as peak day, peak hour, average logins per student, and the infrequent-user proportion collectively constitute an evidence base for justifying budget requests, infrastructure investments, and operational policy decisions to institutional leadership [3], [7]. This model of evidence-based library governance is fully consistent with the management information systems frameworks articulated by Laudon and Laudon, which position operational transaction data as the foundation for organizational planning and resource allocation [3].

The 83.0% share of infrequent users, for instance, signals a concrete opportunity for targeted engagement campaigns—library orientation sessions, scheduling notifications, and curated resource promotions—aimed at converting occasional visitors into regular patrons [2], [8], [9]. Extending the present analysis to a full academic semester would provide a more robust evidence base, enabling the detection of examination-period demand spikes, semester-long trends, and the cumulative impact of institutional events on library utilization [6], [7].

## V. CONCLUSION

This paper demonstrates that the HEU Library Attendance and Security Login System generates a sufficient operational dataset from which to derive actionable institutional intelligence. Analysis of 9,727 login events from 3,382 unique student patrons across seven operating days from April 6 to 16, 2026 yields three principal findings. First, Monday is the consistently highest-demand day, with April 6 alone accounting for 50.8% of all period login events—establishing a clear evidential foundation for peak-day staffing protocols [3], [7]. Second, the 12:00–13:59 window is the library's structural peak period, concentrating 27.1% of all login events within two consecutive hours, a pattern consistent across six of the seven operating days [1], [2]. Third, the patron population is composed predominantly of infrequent

visitors (83.0%), with a small high-frequency core (3.4%) that drives disproportionate kiosk demand during peak hours.

Together, these findings support four evidence-based recommendations: (1) assigning maximum personnel coverage on Mondays and during the 12:00–14:00 window [3], [7]; (2) activating a secondary kiosk or manual contingency lane during the midday peak [5]; (3) leveraging the system’s real-time occupancy data for emergency preparedness and security monitoring [4], [8]; and (4) developing engagement campaigns targeting the large infrequent-user population [2], [8], [9]. Future work should extend this analysis to a full academic semester, automate weekly KPI reporting, and explore the integration of attendance records with academic performance data—within applicable data privacy frameworks—to measure the educational impact of library utilization on student outcomes [6], [9].

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