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IoT-Based Smart Lighting Control and Monitoring System for Building Corridors with Fault Detection Alerts

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***Abstract*—Corridor lighting in commercial and institutional buildings may remain energised during unoccupied periods, resulting in unnecessary electricity consumption. This paper presents an Internet of Things (IoT)-based smart lighting control and monitoring system for building corridors with lamp-fault indication and timestamped event logging. The laboratory-scale prototype integrates an ESP32 microcontroller, a passive infrared sensor, a three-channel relay module, three ACS712 current sensors, three 9 W LED lamps, the Blynk IoT platform, Google Apps Script, and Google Sheets. System evaluation comprised one controlled lamp-disconnection test per channel and an energy estimate derived from 193 timestamped categorical records collected over a 168.010 h observation window. Lamp ON intervals were reconstructed separately for each channel to prevent repeated or overlapping events from being counted more than once. The reconstructed operation produced an estimated lamp energy consumption of 96.59 Wh, compared with 4536.27 Wh for a theoretical continuously operated baseline. This corresponds to an estimated upper-bound saving of 97.87%. Fault indications were generated for the three controlled lamp disconnections and recorded through the cloud monitoring system. The results demonstrate the functional integration of occupancy-responsive lighting control, current-threshold fault indication, remote monitoring, and event logging. The reported energy saving is a rated-power estimate against an always-on baseline.**

***Index Terms*—Building corridor, energy efficiency, ESP32, fault detection, Internet of Things (IoT), smart lighting system.**

I. INTRODUCTION

Lighting systems are among the major sources of electricity consumption in commercial, educational, and institutional buildings, particularly in corridors that require continuous illumination to ensure user safety and visibility. In many existing buildings, corridor lighting is still operated manually or remains switched on continuously regardless of occupancy. This practice leads to unnecessary energy consumption, higher electricity costs, and inefficient use of electrical energy. Various intelligent lighting approaches have been introduced to reduce energy wastage while maintaining a safe and comfortable indoor environment [1].

Recent advances in the IoT have transformed the monitoring and control of electrical systems. Modern lighting systems integrate sensors, wireless communication technologies, and embedded controllers to operate automatically in response to real-time environmental conditions while enabling remote performance monitoring [2-4]. Passive infrared (PIR) sensing provides a practical means of detecting movement for occupancy-responsive switching.

In the present prototype, an ESP32 controls lamp relays, Blynk provides remote monitoring, and Google Apps Script transfers event records to Google Sheets. Related works has demonstrated connected lighting and monitoring in classrooms and other IoT applications [5, 6]. Despite the improvements reported in previous IoT-based lighting studies, many existing systems still provide limited support for fault detection, event logging, and system performance analysis.

This study combines PIR-based lighting control, Blynk monitoring, current-threshold fault indication, and Google Sheets event logging in a laboratory-scale corridor-lighting prototype. Its contribution is practical system integration and a reproducible analysis of timestamped categorical lamp states; comparative superiority and long-term building performance are outside the study scope.

II. LITERATURE REVIEW

A. IoT-Based Smart Lighting Systems

IoT technology has enabled lighting systems to operate automatically by integrating sensors, controllers, and wireless communication. In comparison with conventional lighting systems, IoT-based systems reduce unnecessary energy consumption while allowing users to monitor and control lighting remotely. Previous studies have applied IoT technology in street lighting, greenhouse lighting, and smart building applications, where the lighting operation is controlled automatically [7-9]. Their potential to reduce lamp operating time depends on occupancy, environmental inputs and the reference operating schedule.

Previous studies have demonstrated the effectiveness of IoT-based automatic lighting control in improving energy efficiency through motion detection and ambient light sensing [10]. Other studies have incorporated remote monitoring and fault detection

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to improve lighting maintenance and operational reliability [11]. However, these studies have addressed different aspects of intelligent lighting systems, and the integration of occupancy-based control, real-time monitoring, automated event logging, and individual lamp fault detection within a unified, low-cost corridor lighting platform remains an area for further investigation. Therefore, the proposed system integrates these functionalities into a single IoT-based corridor lighting system to improve energy efficiency, operational monitoring, and maintenance support.

B. Real-Time Monitoring and Data Logging

Real-time monitoring and automated data logging are essential features of IoT-based lighting systems, enabling remote supervision of lighting operations and systematic recording of operational data. Information such as lamp status, motion detection, switching events, and fault notifications can be monitored and recorded for subsequent performance evaluation. Previous studies have explored IoT-based energy monitoring, daylight-responsive lighting, and intelligent lighting control to improve energy efficiency and operational management [12-14].

Cloud-based monitoring and automated data logging enable the collection and management of operational data in IoT-based systems. Kim and Kim [15] highlighted the importance of logging and monitoring in cloud-connected IoT applications, while a recent study [16] demonstrated an ESP32-based streetlight monitoring system using cloud storage for fault detection and remote monitoring. Timestamped event records support the analysis of lighting operations, switching frequency, and fault occurrences. Additional electrical measurements are required to determine actual energy consumption.

C. Fault Detection in Smart Lighting Systems

Fault detection is essential in lighting systems, particularly in low-occupancy corridors where lighting failures may go unnoticed. Previous studies have explored automated fault detection and reporting to improve system reliability and reduce maintenance requirements [7, 11, 17]. Balasubramanian et al. [18] investigated centralised streetlight monitoring and control, while Zainudin and Supiyan [19] presented an ESP32-based lighting system incorporating light and motion sensors with smartphone monitoring. These studies highlight the importance of remote monitoring and automated lighting control.

However, reliable fault detection requires appropriate sensor calibration and threshold validation. Integrating fault detection with real-time monitoring and automated event logging can support early fault identification, reduce manual inspection requirements, and improve maintenance efficiency in IoT-based corridor lighting systems.

D. Energy Efficiency in Building Corridor Lighting

Lighting systems contribute significantly to the electricity consumption of commercial and institutional buildings because they often remain switched ON even when the corridor is unoccupied. Occupancy-responsive lighting reduces lamp operating time when occupancy is intermittent. Building monitoring and small-scale IoT energy monitoring provide relevant context for energy evaluation [20, 21]. In this proposed study, energy is estimated from rated lamp power and timestamped ON states. It is not measured with an energy meter, and the reference is a theoretical always-on schedule rather than a monitored conventional installation.

Table I compares the proposed system with selected previous studies in terms of IoT implementation, PIR-based occupancy detection, cloud monitoring, fault detection, and Google Sheets logging. The comparison identifies the functions integrated in the proposed prototype. This approach not only reduces unnecessary operating time but also provides quantitative operating data that can be used to estimate energy consumption and evaluate overall system efficiency.

TABLE I. COMPARISON OF PREVIOUS STUDY

Previous Study	IoT	PIR	Cloud Monitoring	Fault Detection	Google Sheet Log
[5]	✓	✓	✓	✗	✗
[12]	✓	✗	✓	✗	✗
[7]	✓	✗	✓	✓	✗
Proposed System	**✓**	**✓**	**✓**	**✓**	**✓**

III. METHODOLOGY

A laboratory-scale IoT lighting prototype was designed and evaluated for corridor-lighting control and monitoring. The prototype integrated an ESP32 controller, a PIR motion sensor, a three-channel relay module, three ACS712 current-sensing channels, three 9 W LED lamps, Wi-Fi communication, the Blynk platform, Google Apps Script, and Google Sheets. The evaluation addressed current-threshold fault indication, event logging, and estimated lamp energy use.

A. System Design and Architecture

The proposed system was developed as a laboratory-scale IoT lighting-control and monitoring prototype. As illustrated in Fig. 1, the control process begins with the initialisation of the ESP32, PIR sensor, three ACS712 current-sensing channels, relay module, Wi-Fi connection, and Blynk interface. The lamps are initially maintained in the OFF state. When the PIR sensor detects motion, the ESP32 commands the three-channel relay module to switch the lamps ON. If no further motion is detected, the lamps are switched OFF after the configured 30 s inactivity interval. Blynk provides remote lamp-control and monitoring functions; however, remote-command performance was not evaluated separately in this study.

While a lamp relay is commanded ON, the ESP32 reads the corresponding ACS712 sensor and compares the reading with the implemented fault threshold. A below-threshold reading is classified as a fault condition for that lamp channel. The controller then updates the lamp status displayed in Blynk and generates an event record through Google Apps Script. After each control and monitoring cycle, the system waits for a short

interval before repeating the sensing, control, fault-checking, and logging sequence.

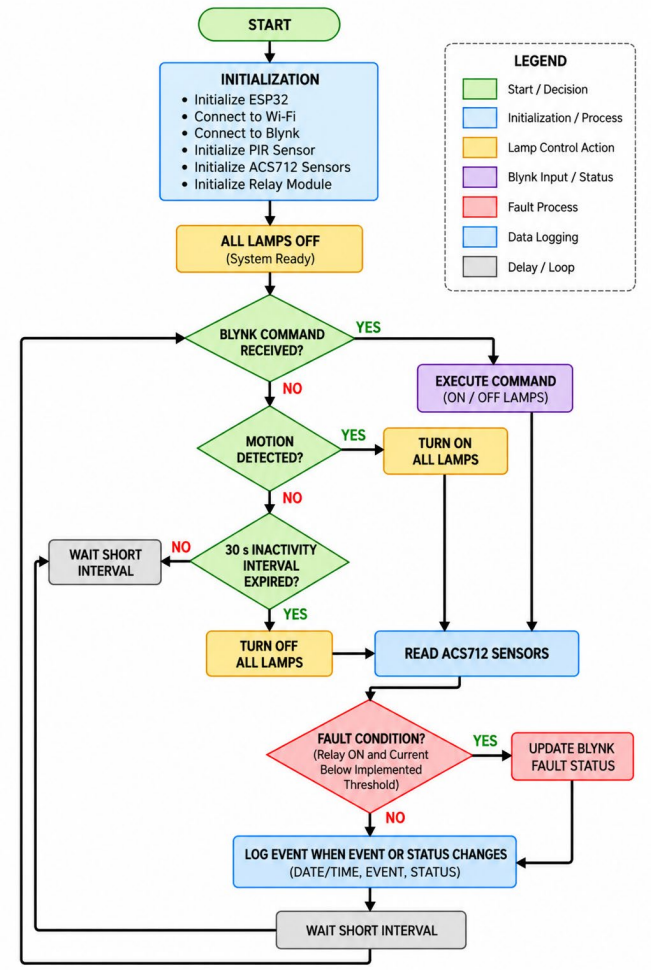

Fig. 1. Operational flowchart of the proposed IoT-based smart lighting system.

Fig. 2 presents the functional architecture of the prototype. The PIR sensor and Blynk application provide inputs to the ESP32, which performs input processing, relay control, fault identification, status monitoring, and communication with the cloud-based logging service. The three-channel relay module controls the AC supply to the three 9 W LED lamps. Each lamp channel incorporates an ACS712 sensor in its current path, allowing the controller to assess whether current is present when the corresponding relay is activated. The power path for each channel comprises the miniature circuit breaker, ACS712 sensor, relay contact, and lamp, with a common neutral connection.

Operational events are transmitted through Google Apps Script and retained in Google Sheets. The verified workbook contains the fields DATE/TIME, EVENT, and categorical STATUS. These records were used to reconstruct the lamp-state intervals for the energy-consumption estimate. The retained dataset does not contain raw current samples, measured relay-transition times, or paired command-and-response timestamps. Therefore, the current magnitude and system response time were not evaluated as logged performance measures.

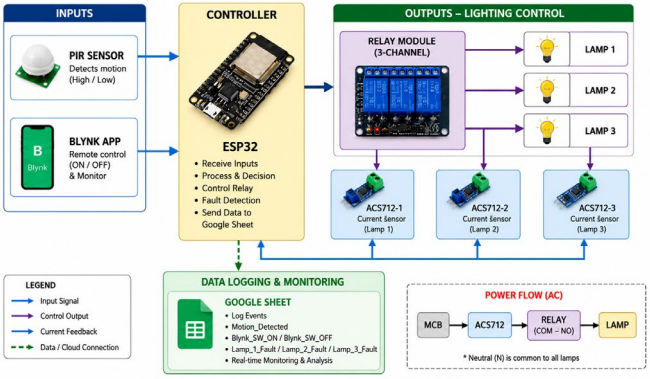

Fig. 2. Functional block diagram of the proposed IoT-based smart lighting control and monitoring system.

B. Performance Evaluation

The prototype was assessed using controlled lamp-disconnection demonstrations and a lamp-energy estimate derived from rated power and timestamped categorical states. These tests characterise the laboratory prototype only. They do not establish long-term field reliability, electrical-energy metering accuracy, or comparative superiority over an installed conventional system.

1) Fault Detection

Fault indication was evaluated by maintaining the relay of the tested channel in the ON state and disconnecting the corresponding lamp. Under this condition, the ACS712 reading was compared with the implemented fault threshold for that channel. The fault thresholds were set to 0.092 A, 0.080 A, and 0.075 A for Lamps 1, 2, and 3, respectively. Separate recovery thresholds of 0.098 A, 0.086 A, and 0.081 A were applied to provide hysteresis before a channel returned to its normal state.

Each lamp channel was subjected to one controlled disconnection test. The recorded outcome was limited to whether the induced fault was detected. Therefore, the procedure does not support estimates of detection accuracy, sensitivity, specificity, false-alarm rate, or long-term reliability. The seven Fault_Detected entries in the event log represent operational event records and were not treated as seven independent validation trials. Furthermore, the threshold values are controller settings and are not measurements of the lamps' normal operating currents.

2) Energy Consumption Analysis

Lamp energy consumption was estimated from the lamps' rated power and the timestamped categorical states recorded in the Google Sheet log; it was not measured using an energy meter. The log contained 193 records covering the observation window from June 28, 2026 to July 5, 2026. The records were processed chronologically, and the recorded state of each lamp was assumed to persist until a subsequent record indicated a change. No lamp-state transition was excluded based on its event label, thereby avoiding selective omission of recorded operating periods.

The prototype employed three LED lamps, each rated at 9 W. Therefore, the maximum simultaneous rated lighting power was calculated as in Eq. (1).

$$\boldsymbol{P}_{\text{total}} = \sum_{\boldsymbol{j=1}}^{\boldsymbol{3}} \boldsymbol{P_j} = \boldsymbol{3(9W) = 27W} \quad (1)$$

where P_j is the rated power of lamp j.

The ON duration of each lamp was reconstructed independently from the chronologically ordered STATUS records. An ON interval began when the recorded state of a lamp changed from a non-ON state to ON and ended when its state subsequently changed to OFF or FAULT. Consecutive records in which the lamp remained ON did not initiate additional intervals. This interval-reconstruction rule prevented repeated motion detections and overlapping control events from being counted more than once and avoided assigning an independent 30 s operating period to every Motion_Detected record. For lamp j, the reconstructed-ON duration was calculated as in Eq. (2).

$$T_j = \sum_{k=1}^{n_j} (t_{\text{off},j,k} - t_{\text{on},j,k}) \quad (2)$$

where $t_{\text{on},j,k}$ and $t_{\text{off},j,k}$ are the start and end timestamps of ON interval k, respectively, and n_j is the number of reconstructed ON intervals for lamp j.

A FAULT state was not assigned the lamp's 9 W rated power because the log did not contain raw current or power measurements from which consumption during the fault condition could be determined. When a record indicated a fault in only one channel, the ON intervals of the unaffected lamps were retained according to their recorded states. The estimated lighting energy was then calculated separately for each lamp and summed as in Eq. (3).

$$E_{\text{proposed}} = \sum_{j=1}^{3} P_j T_j \quad (3)$$

where T_j is expressed in hours, giving E_{proposed} in watt-hours.

A theoretical continuously operated baseline was used for comparison. Under this upper-bound scenario, all three lamps were assumed to operate continuously throughout the same observation duration, T_{obs} as in Eq. (4).

$$E_{\text{baseline}} = P_{\text{total}} T_{\text{obs}} \quad (4)$$

The relative energy saving was calculated as in Eq. (5) below:

$$\text{Energy saving}(\%) = \frac{E_{\text{baseline}} - E_{\text{proposed}}}{E_{\text{baseline}}} \times 100 \quad (5)$$

The calculation represents lamp energy only. It excludes the consumption of the ESP32, PIR sensor, ACS712 sensors, relay electronics, Wi-Fi communication, standby operation, and power-supply losses.

Energy consumption in this study was estimated using the available timestamped lamp-state records and a theoretical continuously operated baseline. The analysis assumed that the event log contained the state transitions required to reconstruct the operating intervals. However, log completeness could not be independently verified because no separate reference record of expected events was available. The resulting percentage was therefore treated as an estimated upper-bound saving rather than as the energy saving expected under realistic building operating schedules.

IV. Results and Discussion

A. Hardware Prototype

Fig. 3 shows the laboratory-scale hardware prototype. It consists of an ESP32 microcontroller, a PIR motion sensor, a three-channel relay module, three LED lamps representing corridor lighting, and three current-sensing channels for lamp-fault indication. The components were assembled on a prototype board for integrated functional evaluation.

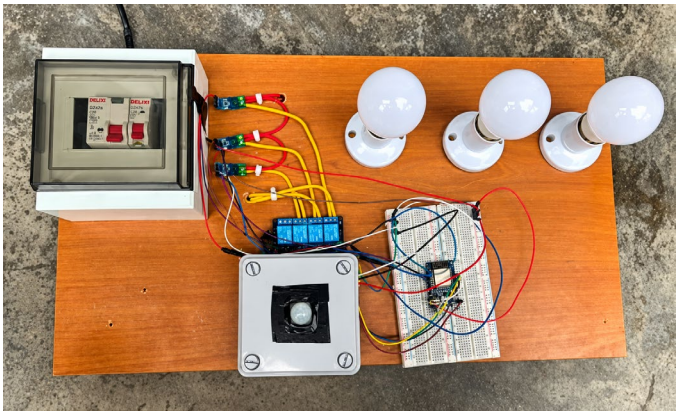

Fig. 3. Hardware prototype of the proposed smart lighting system.

The ESP32 processes the PIR and current-sensor inputs before controlling the relay module. During automatic operation, motion commands the lamps ON, and the lamps are commanded OFF after the configured 30 s inactivity interval when no further motion is detected. When a lamp was disconnected while its relay remained ON, the corresponding current reading fell below the implemented threshold, producing a fault indication on Blynk and a categorical fault record in Google Sheets.

The fault detection function was evaluated by removing one of the lamps while the corresponding relay remained ON. Under this condition, the current sensor detected a drop in current below the predefined threshold value, allowing the ESP32 to identify the lamp as faulty. The fault status was then displayed on the Blynk dashboard and automatically recorded in Google Sheets for monitoring purposes.

B. Software Implementation

The software consists of the ESP32 firmware, the Blynk IoT platform, Google Apps Script, and Google Sheets. These components communicate through Wi-Fi to perform automatic lighting control, remote monitoring, fault indication, and timestamped event logging. The ESP32 monitors the PIR and current-sensor inputs, controls the relay outputs, and updates the system status.

Fig. 4 shows the Blynk dashboard used to monitor the prototype. The dashboard displays PIR status, relay status, and individual lamp condition. For fault indication, the ESP32

compares each current-sensor reading with the corresponding implemented threshold while the relay is ON. A below-threshold condition updates the lamp status on Blynk and generates a categorical event record through Google Apps Script.

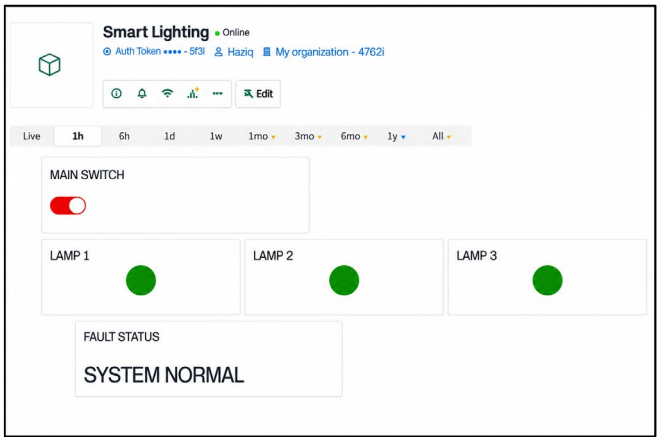

Fig. 4. Blynk dashboard for the proposed smart lighting system.

Fig. 5 shows the fault status displayed on the Blynk dashboard. During testing, the fault condition was created by removing one of the lamps while the corresponding relay remained ON. As the measured current dropped below the predefined threshold, the ESP32 successfully detected the fault and updated the lamp status on the Blynk dashboard. The same event was automatically transmitted to Google Sheets for future monitoring and analysis.

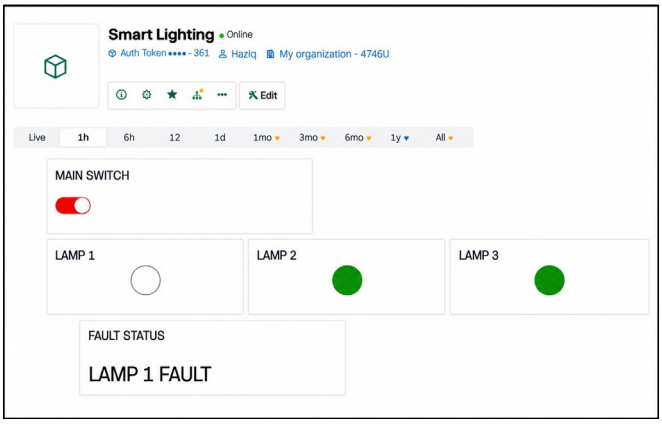

Fig. 5. Fault detection display dashboard.

C. Google Sheet Event Logging

Fig. 6 illustrates the event-recording interface used during the observation period. In this workbook log, each record contains a timestamp, an event label, and a categorical lamp-status field. Raw current, command-source, relay-transition, and latency measurements were not present in the retained export.

The source workbook contains 193 records within the defined observation window. Their timestamps and categorical lamp states provide an operating history for state-interval reconstruction. Because no independent transmission audit or expected-record register was available, the dataset does not establish that every generated event was received without loss.

	A	B	C
1	DATE/TIME	EVENT	STATUS
2	6/28/2026 22:16:26	Motion_Detected	Lamp1_ON_Lamp2_ON_Lamp3_ON
3	6/28/2026 22:17:03	No_Motion	Lamp1_OFF_Lamp2_OFF_Lamp3_OFF
4	6/28/2026 22:35:42	Motion_Detected	Lamp1_ON_Lamp2_ON_Lamp3_ON
5	6/28/2026 22:36:15	No_Motion	Lamp1_OFF_Lamp2_OFF_Lamp3_OFF
6	6/28/2026 22:41:41	Motion_Detected	Lamp1_ON_Lamp2_ON_Lamp3_ON
7	6/28/2026 22:42:13	No_Motion	Lamp1_OFF_Lamp2_OFF_Lamp3_OFF
8	6/28/2026 23:14:19	Motion_Detected	Lamp1_ON_Lamp2_ON_Lamp3_ON
9	6/28/2026 23:15:17	No_Motion	Lamp1_OFF_Lamp2_OFF_Lamp3_OFF
10	6/28/2026 23:15:58	Physical_Switch_ON	Lamp1_ON_Lamp2_ON_Lamp3_ON
11	6/28/2026 23:17:18	Physical_Switch_OFF	Lamp1_OFF_Lamp2_OFF_Lamp3_OFF
12	6/29/2026 1:44:33	Fault_Detected	Lamp1_FAULT_Lamp2_FAULT_Lamp3_FAULT
13	6/29/2026 1:45:06	No_Motion	Lamp1_OFF_Lamp2_OFF_Lamp3_OFF
14	6/29/2026 1:50:30	Fault_Detected	Lamp1_FAULT_Lamp2_FAULT_Lamp3_FAULT
15	6/29/2026 1:51:35	No_Motion	Lamp1_OFF_Lamp2_OFF_Lamp3_OFF
16	6/29/2026 1:52:14	Fault_Detected	Lamp1_FAULT_Lamp2_FAULT_Lamp3_FAULT
17	6/29/2026 1:53:12	No_Motion	Lamp1_OFF_Lamp2_OFF_Lamp3_OFF
18	6/29/2026 1:54:21	Motion_Detected	Lamp1_ON_Lamp2_ON_Lamp3_ON
19	6/29/2026 1:54:54	No_Motion	Lamp1_OFF_Lamp2_OFF_Lamp3_OFF
20	6/29/2026 1:57:53	Motion_Detected	Lamp1_ON_Lamp2_ON_Lamp3_ON
21	6/29/2026 1:58:25	No_Motion	Lamp1_OFF_Lamp2_OFF_Lamp3_OFF
22	6/29/2026 2:04:32	Fault_Detected	Lamp1_FAULT_Lamp2_ON_Lamp3_ON
23	6/29/2026 2:05:04	No_Motion	Lamp1_OFF_Lamp2_OFF_Lamp3_OFF
24	6/29/2026 2:13:51	Motion_Detected	Lamp1_ON_Lamp2_ON_Lamp3_ON
25	6/29/2026 2:14:23	No_Motion	Lamp1_OFF_Lamp2_OFF_Lamp3_OFF

Sheet1

Fig. 6. Google Sheets workbook for event logging.

Table II summarises the 168 records included in the descriptive event-frequency analysis, comprising 77 Motion Detected, 84 No Motion, and 7 Fault Detected records. Twenty-five local-control records were excluded because local-control evaluation was outside the study scope. However, their recorded lamp-state transitions were retained in the energy reconstruction to avoid selectively understating lamp operating time.

TABLE II . OCCUPANCY AND FAULT EVENTS INCLUDED IN DESCRIPTIVE ANALYSIS

Event	Number of Events
Motion Detected	77
No Motion	84
Fault Detected	7
Total Events	**168**

Seven Fault Detected records appear in the observation window. These are logged events rather than seven independent controlled validation trials. The difference between Motion Detected and No Motion counts partly reflects fault-related state changes and therefore must not be interpreted as proof that every 30 s inactivity interval completed exactly as programmed.

Fig. 7 presents the daily distribution of the 168 occupancy-related and fault event records. The highest number of events was recorded on 29 June, with 17 Motion Detected, 21 No Motion, and 4 Fault Detected records. From 30 June to 4 July, the daily event totals ranged from 16 to 27, with Motion Detected and No Motion records occurring in similar numbers. Three additional fault records were logged on 5 July. The first and final dates represent partial observation days and should not be compared directly with the intervening full dates.

Furthermore, the seven fault entries represent logged events rather than seven independent validation trials. The figure only describes the temporal distribution of recorded events during the observation days.

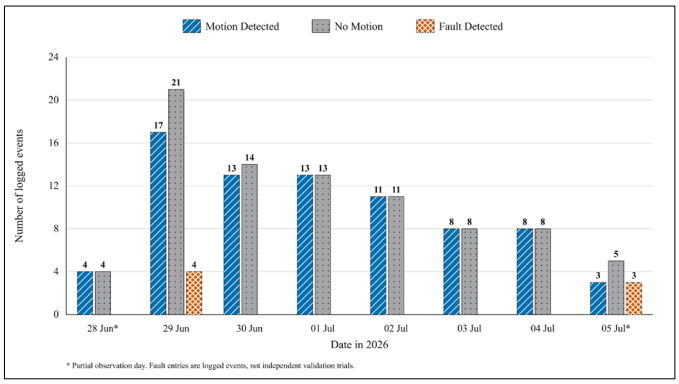

Fig. 7. Daily distribution of occupancy-related and fault event records during the observation window.

D. Performance Evaluation

1) Fault Detection

Fault indication was evaluated by disconnecting each lamp individually while its corresponding relay remained ON. The current-sensor reading then fell below the implemented threshold, and the ESP32 identified the affected channel, updated the Blynk status, and generated a categorical fault record in Google Sheets. This controlled procedure evaluated detection outcome only and did not measure detection latency.

Table III reports the documented outcome of one controlled disconnection demonstration for each lamp channel. These three demonstrations must be distinguished from the seven Fault Detected event records in the observation log. The fault status was displayed on the Blynk dashboard and recorded in Google Sheets. The controlled evaluation comprised one disconnection demonstration per lamp channel and did not test loose connections, intermittent faults, or false alarms. Repeated testing under a wider range of operating conditions is required before detection accuracy or reliability can be quantified.

TABLE III. FAULT DETECTION TEST

Lamp	Fault Introduced	Fault Detected	Blynk Notification	Google Sheet Log
Lamp 1	Yes	Yes	Yes	Recorded
Lamp 2	Yes	Yes	Yes	Recorded
Lamp 3	Yes	Yes	Yes	Recorded

2) Energy Consumption Analysis

Table IV summarises the reconstructed ON duration and estimated energy consumption for each lamp channel. Lamp 1 had an ON duration of 12,855.067 s (3.571 h), whereas Lamps 2 and 3 each had an ON duration of 12,891.143 s (3.581 h). The small difference between the channels reflects their recorded categorical state transitions and does not indicate a difference in lamp efficiency or electrical performance. Based on the rated power of 9 W per lamp, the estimated energy consumption was 32.14 Wh for Lamp 1 and 32.23 Wh each for Lamps 2 and 3, giving a total estimated lamp energy consumption of 96.59 Wh.

TABLE IV . RECONSTRUCTED ON DURATION AND ESTIMATED ENERGY BY LAMP

Lamp channel	ON duration (s)	ON duration (h)	Rated power (W)	Estimated energy (Wh)
Lamp 1	12,855.067	3.571	9	32.14
Lamp 2	12,891.143	3.581	9	32.23
Lamp 3	12,891.143	3.581	9	32.23
Total	**38,637.353**	**10.733**[1]	-	**96.59**

The reported value represents the estimated energy consumption of the three lamps only. It was derived from the rated lamp power and reconstructed ON durations rather than from direct energy-meter measurements. The estimate excludes the consumption of the ESP32, PIR sensor, ACS712 sensors, relay electronics, Wi-Fi communication, standby operation, and power-supply losses. Energy associated with a recorded FAULT state was also excluded because the retained log did not contain the current or power measurements required to quantify it.

Table V compares the reconstructed lamp energy with a theoretical continuously operated baseline. The theoretical baseline represents a scenario in which all three 9 W lamps remain continuously switched ON throughout the 168.010 h observation period, resulting in an estimated energy consumption of 4536.27 Wh. In comparison, the reconstructed lamp operation consumed an estimated 96.59 Wh, equivalent to approximately 2.13% of the baseline. The resulting difference of 4439.68 Wh corresponds to an estimated upper-bound energy saving of 97.87%.

TABLE V. ESTIMATED ENERGY COMPARISON WITH THE THEORETICAL ALWAYS-ON BASELINE

Comparison measure	Estimated energy (Wh)	Relative to baseline (%)
Reconstructed lamp operation	96.59	2.13
Theoretical always-on baseline	4536.27	100.00
Estimated upper-bound saving	**4439.68**	**97.87**

The estimated saving should not be interpreted as the saving expected from deployment in an occupied building because the comparison uses a theoretical always-on baseline rather than a monitored conventional lighting installation. A conventional system operating according to working hours, scheduled control, or user behaviour would have a lower baseline consumption and consequently a lower relative saving. Actual field performance would also depend on occupancy patterns, operating schedules, installation conditions, auxiliary-system consumption, and the completeness of the recorded state transitions.

V. CONCLUSION

This study successfully developed and demonstrated a laboratory-scale IoT-based smart lighting system that integrates PIR occupancy detection, ESP32 relay control, ACS712 current sensing, Blynk monitoring, fault indication, and Google Sheets event logging for building corridors. The main contribution is the integration of occupancy-responsive lighting control, channel-level fault indication, remote status monitoring, and timestamped operational records within a single prototype. Energy analysis using the observation window of 193-record log estimated lamp consumption at 96.59 Wh, compared with 4536.27 Wh for a theoretical continuously operated baseline, corresponding to an upper-bound saving of 97.87%. Controlled disconnection of each lamp channel generated the intended fault indication. However, the evaluation was confined to a laboratory-scale prototype, with one controlled disconnection test per channel, categorical event records, and energy estimates derived from rated lamp power. Consequently, the findings do not quantify whole-system energy consumption, system response time, event-log completeness, fault-detection accuracy, false-alarm performance, or long-term reliability. Future research should conduct extended trials in operational building corridors under representative occupancy and lighting schedules, measure whole-system consumption using calibrated energy meters, independently verify logging completeness, evaluate repeated and intermittent fault conditions, and compare the system directly with monitored conventional lighting installations at a larger scale.

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