

Automatic Chicken Coop Cleaner

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DOI: <https://doi.org/10.30880/emait.2025.06.02.004>

Article Info

Received: 3 October 2025
Accepted: 8 December 2025
Available online: 31 December 2025

Keywords

Automatic cleaner, chicken coop cleaner

Abstract

The automatic chicken coop cleaner is designed to sustain hygiene for small scale poultry breeders. This system is developed using an ESP8266 NodeMCU V3 microcontroller which features both scheduled and trigger remote cleaning via Blynk application supported when needed. Manual cleaning is time-consuming, inconsistent, and frequently neglected, particularly among breeders who balance poultry keeping with full-time employment or other responsibilities. Accumulated waste leads to increased moisture, ammonia buildup, and pathogen growth. Poor hygiene contributes to respiratory infections, reduced growth performance, and increased mortality. The cleaning mechanism is driven by a linear actuator and a scraper blade, programmed to operate on a fixed schedule twice daily. The prototype with dimensions of 2feet by 2feet is optimized for 5 to 10 chicks aged 1 to 4 weeks which crucial period for immune system development. The complete cleaning process involves scraper movement forward and backward and took approximately 160seconds. Execution results demonstrate reliable cleaning performance according to the fixed schedule and consistent remote responsiveness via the Blynk application and notification will be sent. Obstructions able to be detected by the system and failure notifications are sent through both the smartphone and email to facilitate timely intervention. The overall system provides a low cost, energy efficient and smart solution that improves flocks' health, supports operational efficiency and promotes sustainable management.

1. Introduction

Home breeders or small-scale poultry owners typically manage a modest flock often for personal food supply, self-sustaining hobby or as a supplementary source of income. The coop setups are generally built using a wooden structure and wire mesh, consisting of nesting boxes, food and drink containers. Breeders' daily routine will be feeding, egg collection and cleaning which are carried out manually by breeders themselves. Maintaining a clean chicken coop becomes quite a challenge for breeders and often gets postponed or sometimes neglected. To overcome this issue, an automatic chicken coop cleaner is designed to facilitate schedule cleaning.

1.1 Problem Statement

Home breeder or small-scale breeder captivated due to its low startup cost and minimal space requirements. Maintaining a clean coop is vital to ensure the chickens' health and productivity [1]. Part time or home breeders are facing challenges in keeping schedule clean due to time constraints and manual labour required. Unscheduled cleaning may lead to hygienic problems to flocks and surroundings. The accumulation of droppings not only leads to unpleasant odours and unhygienic conditions, but it potentially causes the growth of harmful pathogens and

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ammonia gas, which can cause respiratory problems and decreased egg production [2], [3]. These issues may lead to serious health and productivity consequences [4].

Manual cleaning is time consuming, physically demanding, and often neglected especially by individuals who are balancing routine with other main daily responsibilities. Compared to large scale commercial farms, they benefit from automated waste management systems which are more expensive, bulky, and not suited for small scale applications [5]. Most home breeders lack the financial or technical capacity to implement commercial type automation, leading to dependence on inconsistent manual labour [5], [6]. Therefore, a low cost, reliable, and user-friendly automated cleaning system has been designed for organized cleaning and improve overall flock health.

1.2 Scope

The prototype design considered typical backyard constraints, to ensure that the system remains compact and practical for small scale poultry breeders. Each coop is made of wooden structure with dimensions of 2 feet x 2 feet, well fit to limited spaces of backyard. This prototype setting able to accommodate between 5 to 10 chicks aged 1 to 4 weeks. Chicks these aged claims as critical growth stage where hygiene is vital for survival and healthy development [7]. At this early stage, chicks have underdeveloped immune systems, making them more vulnerable to infections. Poor coop sanitation and hygiene potential lead to coccidiosis and respiratory illnesses to chicks. Additionally, confined structure accelerates the accumulation of ammonia and harmful bacteria. To eliminate this issue, cleaning is scheduled twice a day, as a daily basis routine. This automatic coop cleaner requires a stable Wi-Fi connection to enable remote configuration and notification capabilities. Additionally, a reliable power supply is essential to operate scraping mechanisms, to ensure consistent and automated cleaning performance.

2. Methodology

The chicken coop prototype was constructed using durable wood materials to ensure structural stability and suitable for outdoor use. The coop was designed in a dimension of 2 feet by 2 feet, making it ideal for small scale poultry housing, particularly in residential or urban backyard settings. The wooden base structure provides a stable platform for mounting the motorized scrapper. Non water based scrapper preferred due to movable wooden structure and frequent exposure water will lead to wood swelling, warping, mould formation, and reduce coop durability. It also required a water supply, drainage infrastructure and additional components such as pumps, pipes and valves.

Ventilation slits aspect also been considered to ensure proper airflow for ambient environment of chicken. The lower floor was designed to accommodate the sliding scrapper mechanism, allowing smooth movement of the waste removal. The wooden coop is also coated with a weather-resistant paint to enhance durability. Fig. 1. (a) shows the internal cross section of chicken coop prototype and Fig. 1. (b) shows it in 3D model.

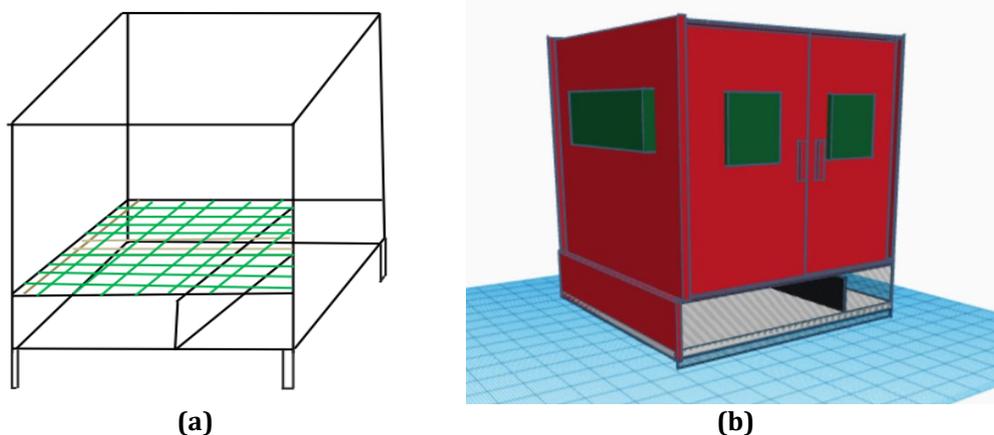


Fig. 1 Chicken coop prototype design (a) cross section; (b) 3D model

Proper alignment and angle of the scraper blade are essential to ensure complete waste removal and avoid leaving behind any residue. A waste collection container is installed at the bottom of the coop to facilitate hygienic disposal and potentially used as organic fertilizer. Fig. 2(a) shows the prototype's internal view of chicken coop, while Fig. 2(b) show the scrapper blade position.

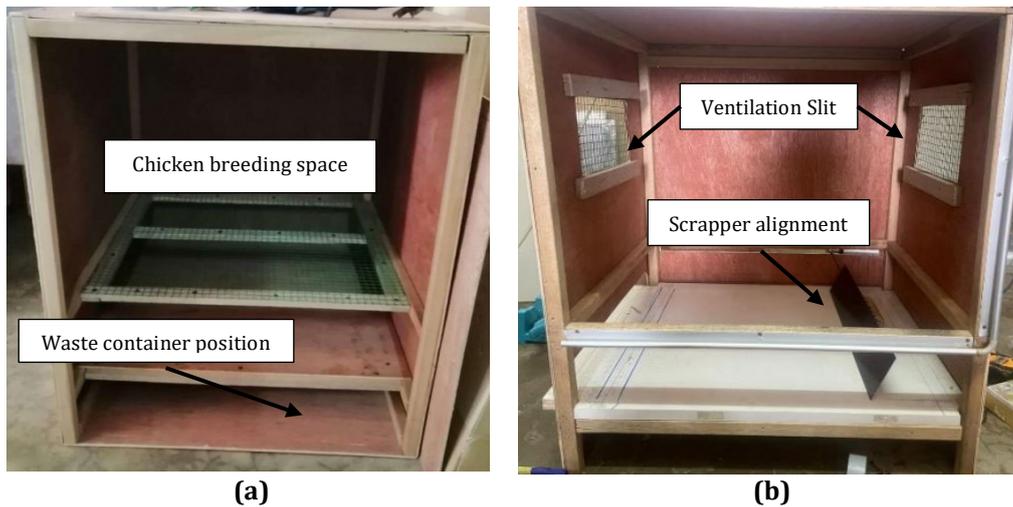


Fig. 2 Chicken coop prototype (a) Internal view; (b) Scrapper blade position

The development of the automatic chicken coop cleaner prototype involved both integration of hardware and software to enable autonomous operation and remote configuration. The ESP8266 NodeMCU V3 was selected as the main controller due to its built-in Wi-Fi features and compatible with the Blynk application. This allows the user to receive cleaning status updates and trigger remote cleaning instruction via smartphone. The scrapping mechanism is driven by a 12V linear actuator motor, which serves as the primary actuator to push and retract the scraper blade along the coop floor. This actuator is controlled using L298N motor driver module which enabling bidirectional actuator movement. A 12V adapter used as power supply to the actuator and controller. Fig. 3 shows circuit diagram connection between ESP8266, motor drive and actuator.

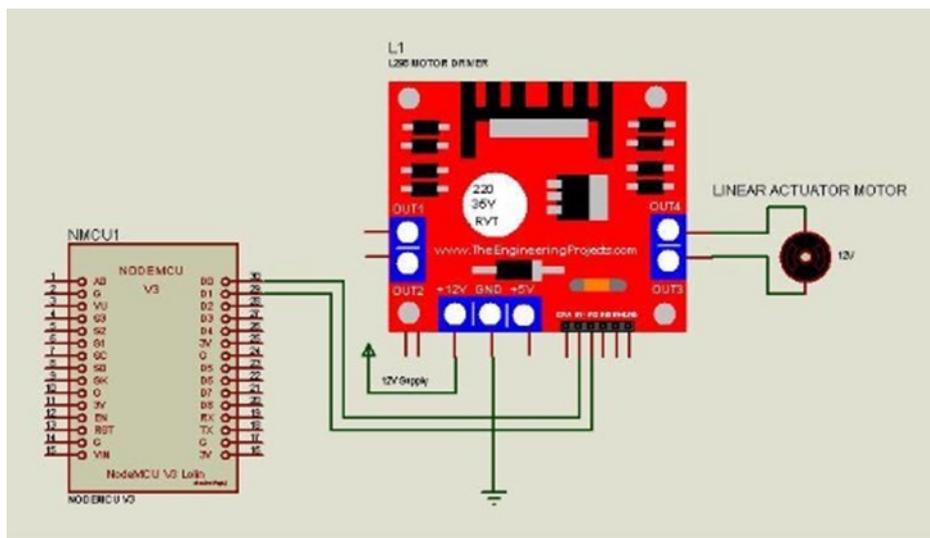


Fig. 3 Circuit diagram

Block diagram for this system shown in Fig. 4. The timer and manual control button in the Blynk application serve as inputs, while the ESP8266 NodeMCU as processor that control and operates tasks accordingly. The output includes the linear actuator's motion and status notifications of success or failure which sent via the Blynk application to smartphone.

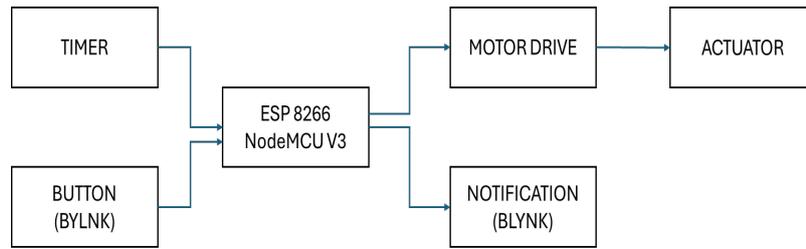


Fig. 4 Block diagram

Fig. 5 shows flow chart of the operation of the automatic chicken coop cleaner. Once the connection is established, the system enters its monitoring state, where it continuously checks for two possible inputs which are predefined cleaning schedule or manual cleaning trigger via the Blynk application. When the scheduled time is detected, the system initiates the cleaning process automatically. Alternatively, the user may manually activate the cleaning function at any time by pressing the 'ON' button on the screen via the Blynk interface. Once either condition is met, the ESP8266 controller sends a signal to the L298N motor driver and then activates the linear actuator motor.

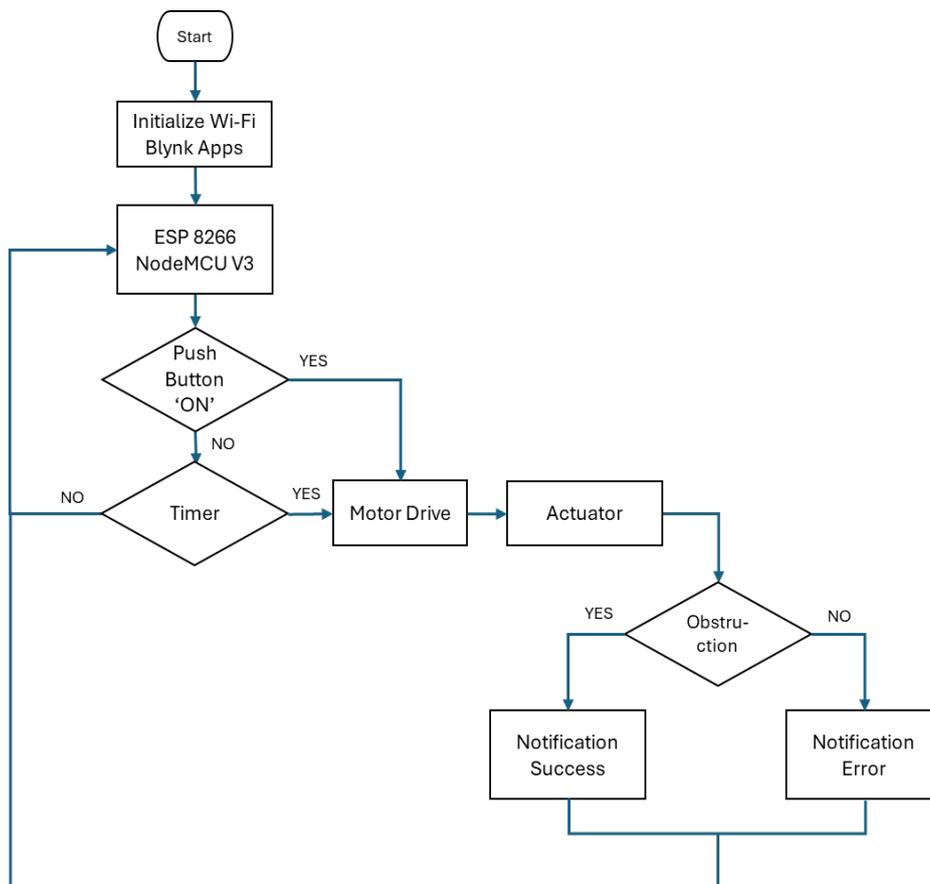


Fig. 5 Flow chart

The actuator performs a forward motion to push the manure scraper blade across the floor, collecting waste into the provided tray. Upon reaching the limit, the actuator retracts the scraper, returning it to its original position. This back-and-forth motion ensures complete cleaning of the coop area. After the cleaning process is completed, a notification will be sent to user via the Blynk application, confirming successful operation. If failure occurs such as the actuator stuck or the cleaning cycle does not complete within a set duration, the system will detect abnormal conditions and failure alert notification will be sent to user for further inspection. It ensures real-time monitoring and hasty response to operational issues. Then it will be idle monitoring state, ready to execute the next scheduled or manual command.

Duration of cleaning process calculated using equation (1). Complete cleaning refers to process of extended and retracted actuator with manure scraper blade attach to it. The scraping distance measures 1.40m. Actuator moves with constant speed of 10mms^{-1} . Theoretically, time required to complete it is 140second.

$$Time = \frac{Distance (m)}{Speed (\frac{m}{s})} \quad (1)$$

3. Result

Several test runs were conducted on Automatic Chicken Coop Cleaner prototype to establish functionality and reliability of product based on schedule accuracy, smoothness of manure scraping mechanism, and manual cleaning triggering via the Blynk application. Cleaning was set to occur at an interval of 12 hours, twice a day scheduled on 8:00a.m. and 8:00p.m. The cleaning interval time been implemented align with recommended poultry hygiene practices and healthier environment condition for chicks during the critical growth stage [5], [6], [9]. Cleaning conducted on early morning to removes overnight waste buildup, while evening cleaning to prevents accumulation during resting period on night. Highest manure accumulation occurs overnight, and early morning cleaning reduce litter moisture, odour and pathogen exposure [8], [9].

During testing, the cleaning process activated on time and accomplished successfully. Manure scraper extended and retracted without failure. Daily manure accumulation for ten chicken's overall weights 40g to 1.4kg, aged 1week to 4 week approximately between 50g - 900g. The actuator successfully completes the scraping task within approximately 160seconds and 183seconds separately without and with manure. The additional operating time are caused by mechanical delays, floor material and load amount during operation. This deviation is considered acceptable, as the system still performs the intended task effectively and reliably.

Fig. 6(a) shows a sample of the popup notification received on a smartphone through the Blynk application, displaying task completion and the next scheduled. To enhance system feedback and redundancy, this system also supports email-based alerts, which can be configured to notify the user upon task completion. Figure 6(b) shows a sample of email notification with the message "CLEANING COMPLETED". Remote trigger was also tested using the Blynk application and real-time cleaning update was displayed through the app and example of notification shown in Figure 6(c).

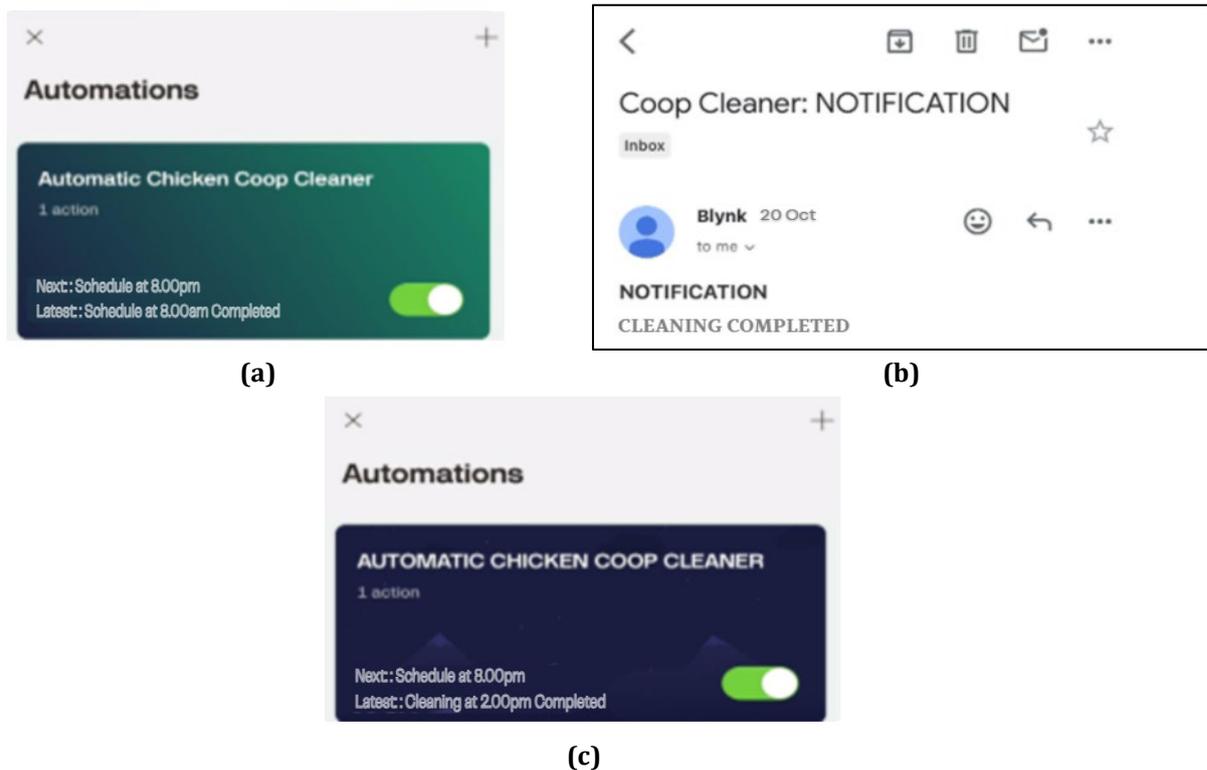


Fig. 6 Notification (a) Blynk - schedule cleaning; (b) Email; (c) Blynk - remote trigger

An additional test scenario was conducted by placing physical obstacles in the scraper path to evaluate the system's fault detection and response capability. Physical obstacles may occur by manure clumps, wood shavings, small feed pellets or other unexpected obstacle such as animals. The presence of obstacle blocks with the actuator's movement, caused delay and incomplete strokes. Under these conditions, the system successfully detected irregularity and failure notifications both sent via Blynk app and email. Fig. 7(a) shows the failure alert on the Blynk app, while Fig. 7(b) displays the corresponding email notification by displaying "CLEANING FAILED" message. These results confirm that the prototype operates reliably under both automatic and remote modes and meets the design expectations for small-scale poultry coop cleaning.

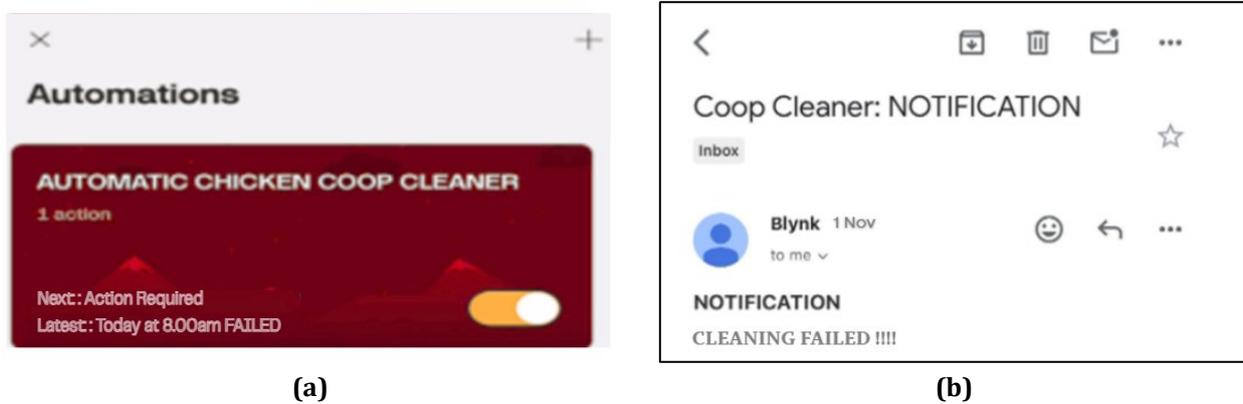


Fig. 7 Notification (a) Blynk; (b) Email

Across multiple trials and preliminary observation, the scraper mechanism achieved 90-95% efficiency, with minor residue resulting from surface adhesion and irregularities on the coop floor. This demonstrates that the scraper approach is adequate for daily waste removal, especially given the relatively low manure volume in small-scale coops. Operating cost for this prototype calculated and it's extremely low within RM1-2/month.

4. Conclusion

Overall, the prototype addresses the key challenges faced by backyard poultry breeders, offering a low-cost, efficient and user-friendly solution that minimizes labour demands and promotes better flock health. The system also contributes toward Sustainable Development Goals (SDGs), particularly in areas of sustainable agriculture, innovation, and responsible production practices. To further enhance the performance, usability, and scalability of the automatic chicken coop cleaner, sensor integration for waste detection is recommended. Incorporate sensors such as infrared or ultrasonic sensors to detect waste accumulation levels. This would allow dynamic scheduling of cleaning cycles based on actual coop conditions rather than fixed intervals, improving efficiency and reducing unnecessary actuator movement.

Acknowledgement

We would like to express our appreciation for the support provided by all parties directly or indirectly involved in this research. We also thank our colleagues and collaborators for their support and assistance throughout the research process.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of the paper. Author Contribution
Study conception and design: Muhammad Azri Suzaimi, Rajabunessa; **analysis and interpretation of results:** Rajabunessa, Muhammad Azri Suzaimi; and **draft manuscript preparation:** Rajabunessa; **review and editing**
Manuscript: Rajabunessa, Muhammad Azri Suzaimi.

Author Contribution

The authors are responsible for the study conception, research design, data collection, data analysis, result interpretation and manuscript drafting.

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