

# IoT-Based Smart Monitoring System for Domestic Animal Shelter Environments

Akhilesh Alapure<sup>1</sup>, Jay Shelke<sup>2</sup>, Saurabh Nawale<sup>3</sup>, Dipalie Pujari<sup>4</sup>

<sup>1,2,3</sup>*Department of Electronics and Telecommunication Engineering, D Y Patil College of Engineering, Akurdi, India*

<sup>4</sup>*Assistant Professor, Department of Electronics and Telecommunication Engineering, D Y Patil College of Engineering, Akurdi, India*

**Abstract** — The health and well-being of shelter domestic animals are directly associated with the conditions of the external environment around them, including air quality, noise levels, humidity, and temperatures. The purpose of this project is to offer the creation of a smart system for animal shelters to monitor an environment with IoT technology. Such a system must continuously check and analyze essential environment parameters in order to maintain good living conditions within the shelter for the domestic animals. Using a combination of sensors implemented with a microcontroller and wireless communication modules, the system captures real-time information and sends it to a centralized cloud-based system. Data captured can be viewed using an intuitive web or mobile interface, allowing shelter personnel to receive notifications and act upon them when conditions stray from set limits. The system also provides data logging and visualization to facilitate long-term data analysis and decision support. With the application of this IoT-based system, the project expects to advance animal welfare, lower stress-induced ailments, and streamline shelter management. The proposed system is scalable, cost-efficient, and suited to shelters with differing capacities, thereby being an excellent tool in promoting standards of care in animal welfare organizations.

**Keywords**— *Internet of Things (IOT), MIT app, ESP32, Sensors.*

## I. INTRODUCTION

Domestic animals like cows are crucial to the livelihood of farmers, making them contribute to agricultural productivity, food availability, and economic stability. The health, safety, and general welfare of these animals must be guaranteed, particularly when they are sheltered. Nevertheless, environmental and security issues in animal shelters usually go unreported or are tackled reactively and not

proactively. Issues like extreme temperature, inadequate ventilation, low water levels, toxic gases, intrusion by other species, and even vandalism can negatively impact animal health and productivity significantly.

High temperatures, for example, change the behavior of animals and promote stress, and low water supply reduces milk in dairy animals greatly. In unfortunate instances, individuals who are unauthorized might try to damage shelters through the introduction of combustible products, causing heartbreaking fires and destroying precious livestock. All these challenge the imperative requirement for a practical and smart system of monitoring in real time potential dangers and changing environmental conditions. The advent of Internet of Things (IoT) provides an efficacious solution for this issue. IoT-based networks allow constant surveillance of physical status through connected sensors, microcontrollers, and cloud-based platforms. In this research, we plan to create a smart, IoT-integrated shelter and security surveillance system designed explicitly for household pet shelters. It utilizes sensors for monitoring temperature, humidity, gases, and water levels. Data from the system is sent to the MIT APP, enabling remote monitoring of shelter conditions by farmers through a mobile application. Alerts are sent in real-time whenever harmful changes or abnormal activity are detected, permitting timely corrective measures. This research is intended to provide a cost-efficient, sustainable, and scalable solution to enhance shelter management, improve animal well-being, and secure farmers' most precious resources. Farmers can monitor the status of their animal shelters remotely in real time through the MIT app mobile application. The system also provides instant alert messages if any

unusual condition or suspicious activity is found. This allows farmers to react immediately, avoiding injury and reducing possible losses. Furthermore, the system facilitates long-term data logging to enable analysis and decision-making. The proposed system is affordable, scalable, and simple to install in shelters of different sizes.

## II.LITERATURE REVIEW

The adoption of Internet of Things (IoT) technology in animal husbandry and shelter management of livestock has become a viable solution to meet numerous issues concerning animal welfare, productivity, and safety. Since domestic animals play a key role in the economic well-being of farming households, their health in shelter environments is of high priority. Over the past few years, there have been several studies on how IoT can be used to improve environmental monitoring and security in animal shelters, but most of the available systems are narrow in scope and not adequate to tackle the complete set of issues faced by farmers. Environmental conditions in animal shelters are important determinants of animal health and productivity. Temperature, humidity, and inadequate ventilation are known to induce stress, dehydration, and illness in animals, especially in cows, which lead to a drastic decrease in the quantity of milk produced. A number of researchers have investigated IoT-based systems for real-time environmental parameter monitoring of temperature, humidity, and gas levels. [1] Yixing Chen and Maher (2020) created a system based on DHT sensors to measure temperature and humidity levels in poultry farms, issuing alerts when thresholds were exceeded. Likewise, [2] K. Rupali and P. N. Vrishanka et al. (2021) suggested an automated livestock shed environment control system that adjusts fans and water misters according to sensor readings. These systems offer minimum environmental control but hardly extend the integration to user alarms in real time or cloud-based access, which in turn restricts their scalability and real-world usability for far-end management. Another notable feature of monitoring in animal shelters is water level management. Proximity to clean and adequate water is crucial in maintaining animal health as well as milk yield. Research work by [3] V. Jyothi and M. Rajani Devi (2022) demonstrated that water

level in water tanks can be successfully monitored by ultrasonic sensors connected through the internet of things to alert the farmer's mobile when water goes below a preconfigured point. These investigations confirm the feasibility of IoT water management systems but tend to address water alone and, in the process, fail to capture the overall environment of the shelter, which is a lost chance to integrate several essential monitoring tasks into one system.

Although the majority of available literature is based on environmental monitoring, fewer works have specifically considered the problem of security at household animal shelters. Unauthorized entry, by either wild animals or humans, can result in injury, theft, or loss of livestock. In certain cases, malicious acts, including setting fires using fire-inducing material, have resulted in devastating losses to shelters and livestock.[4] Rahul Agrawal et al. (2023) proposed a rudimentary security system for barns through the application of motion sensors and alarms but such systems usually are not linked to image capture or remote alerting capabilities. The absence of visual real-time feedback hinders farmers in estimating threats or taking prompt measures. The use of PIR (Passive Infrared) sensors combined with surveillance cameras, especially models like Raspberry Pi Camera Module, has been researched under home automation and intelligent security but is underdeveloped in the context of agriculture. Several recent applications have started to test the benefits of cloud computing and mobile applications in remotely controlling and managing IoT devices. Applications like MIT APP and Firebase have been utilized in various agriculture monitoring applications in order to visualize data, trigger alerts, and even control devices automatically with smartphones.[5] R. Arthi and S. Nishuthan et al. (2020) illustrated the application of MIT APP in the monitoring of greenhouse parameters, whereby farmers were able to see real-time data and receive warning messages when sensor values went beyond safe limits. Such platforms are especially beneficial in rural areas where manual monitoring is not always possible. But most of these systems are crop monitoring or greenhouse applications and are not specifically designed for animal shelter purposes, particularly the combination of environmental data with movement detection and image monitoring. The project involves the design of a smart, IoT-based system that can monitor environmental parameters as

well as shelter security in real-time simultaneously. With the employment of various sensors like DHT11 for temperature and humidity, MQ-series sensors for toxic gases, ultrasonic sensors for water levels, and the system provides comprehensive coverage of the shelter environment. Data is all handled via the MIT APP platform, providing mobile-based real-time alerts as well as control features. This study aims to link environmental monitoring with shelter security, thus helping improve general animal welfare and farming management using sustainable and affordable technology.

### III. METHODOLOGY

The approach for this project is to design and implement an IoT-based system for monitoring environmental and security situations of residential animal shelters. The system combines multiple sensors, a microcontroller, a camera module, and a cloud-based mobile application to facilitate real-time monitoring, alert notifications, and remote access functionality. The project is carried out following a systematic process comprising problem identification, system design, hardware and software development, integration, and testing. It has two major modules: environmental monitoring and security surveillance. The module of environmental monitoring monitors for the variation of temperature, humidity, gas concentration, and water levels, whereas the security module has the functionality of monitoring unwanted motion in and around the shelter as well as imaging intruders or dangers. The hardware utilized in this project is an ESP32 microcontroller because it has inbuilt Wi-Fi features and is efficient in processing multiple sensor inputs. In environmental monitoring, a DHT11 sensor is employed to record temperature and humidity levels. An gas sensor is implemented to sense toxic gases like ammonia, methane, and carbon dioxide, which are prevalent in closed animal shelters. provide proper drinking water to animals, an ultrasonic sensor is utilized to measure water level in the tank and alert when water is low. The MIT APP android application is set to take input from the ESP32 microcontroller through Wi-Fi. By using the app, farmers can see real-time readings from all the sensors and get immediate alerts if any parameter goes beyond a critical value or if there is unauthorized movement. The system also enables the farmer to initiate actions like switching on lights or alarms remotely via the app

interface. All the parts are powered by a 5V power supply with battery backup so that they can keep running even in case of power failure. The communication of data between the sensors, camera, and cloud platform is managed by Wi-Fi protocols. For logging and analysis of data, the system maintains periodic readings which may be retrieved for analyzing historical trends within the shelter environment. The process of development involved programming ESP32 with Arduino IDE, sensor and camera configuration, and their integration with the MIT App using its libraries and mobile app. The system was tested in simulated animal shelter conditions to ensure its performance, responsiveness, and reliability. The outcome proved that the system detected anomalous environment conditions and security breaches effectively and provided timely alerts with high accuracy. This approach guarantees a comprehensive evaluation of enhancing domestic animal shelter conditions by integrating automation, real-time monitoring, and remote control through cost-effective and readily available IoT components.

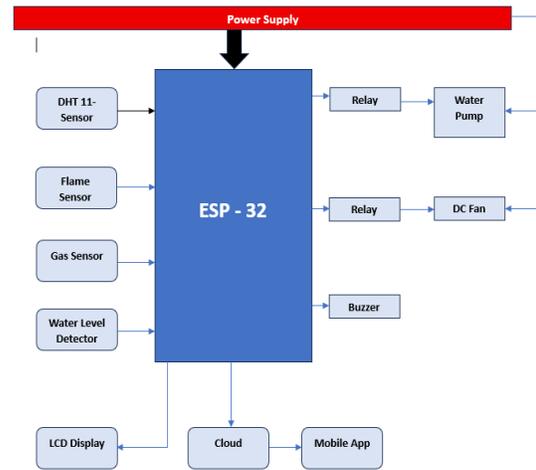


Fig1. Block Diagram of the animal shelter Environment parameters monitoring system

### IV IMPLEMENTATION PLAN

The below flow chart, Figure 2, describes functioning of the devices in the animal shelter. Measure the animals shelter's temperature carefully. The fan will turn on automatically if the temperature exceeds the specified level. The heater will automatically turn on if the temperature falls below the specified level and run until the temperature returns to normal. If any

harmful gas is found in the animal shelter, this device will detect the gas, send the farmer a warning message, and activate the buzzer. The animal shelter's drinking water level is also detected by these devices. The motor pump will automatically start and keep the water level constant if the level is below the specified value [23] [27]. If any detection is made in the animal shelter, as well as alerting the farmer, this device will also turn on a buzzer. It can also be used for security purposes. The whole system is monitored and controlled by the farmer's mobile phone. This system continuously monitors the animal shelter and sends alert messages using the Blynk app.

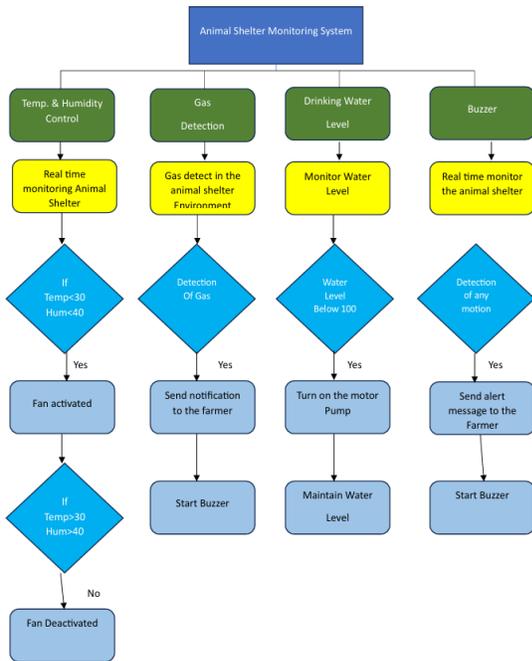


Fig 2 . Working of the Monitoring the animal shelter Environment parameters

V. RESULT AND VALIDATION

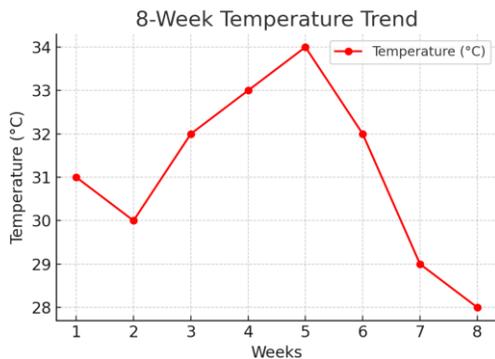


Fig3. Data collected from DHT 11 Sensor

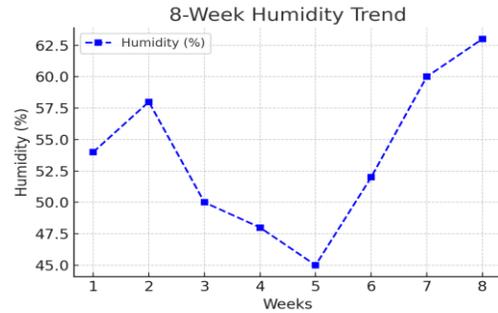


Fig4. Data collected from DHT 11 Sensor

Fig3&Fig4- The diagram illustrates the temperature trend over an eight-week period. The horizontal axis represents the passage of weeks from one to eight, while the vertical axis indicates the temperature in degrees Celsius. A red line connects data points that show the weekly recorded temperatures, with each point marked clearly to reflect changes from week to week. The graph is titled "8-Week Temperature Trend," and a legend in the upper right corner identifies the red line as representing temperature in degrees Celsius. At the start of the observation in week one, the temperature is approximately 31°C. By week two, there is a slight drop to 30°C. Following this dip, the temperature rises consistently over the next three weeks, reaching its peak at 34°C in week five. After reaching this peak, a cooling trend sets in. The temperature drops to 32°C in week six, continues to decrease to around 29°C in week seven, and falls further to 28°C by week eight, marking the lowest point in the recorded period.



**Shelter Monitoring**

**Temp: 32 °C**

**Gas Sensor: Not\_Detected**

**Fire Sensor: Not\_Detected**

**Water Level: RED\_Alert**

**Fan Status: OFF**

Fig.5 Message sent by the devices through MIT App Fig5- Shows the message sent by the devices to the farmer using the MIT app on his mobile phone. This

type of message shows any harmful conditions found in animal shelters. The information like high temperature alerts, gas leakage alerts, water level alerts, security alerts, and any technical fault found in the devices using the MIT app show the alert notification.

## VI. CONCLUSION AND FUTURE STUDIES

The development of a Domestic Animals Shelter Environment Monitoring System using the Internet of Things (IoT) represents a significant step forward in enhancing the welfare, safety, and health of animals housed in shelters. Through the integration of IoT technologies, such as temperature, humidity, and gas sensors connected to microcontrollers and cloud-based platforms, this system enables real-time monitoring and control of environmental conditions. These advancements allow shelter administrators to maintain optimal living conditions, respond promptly to potentially harmful changes, and reduce human error associated with manual monitoring.

The project has demonstrated the effectiveness of using low-cost, scalable, and efficient components like the ESP32 microcontroller, DHT22 and MQ-135 sensors, and Firebase real-time databases to collect, transmit, and visualize environmental data. This not only improves operational transparency and decision-making but also contributes to proactive animal care, preventing health complications caused by unfavorable shelter environments.

Moreover, the system aligns with modern smart shelter initiatives by introducing automation and data-driven management into traditionally manual processes. It showcases how IoT can be practically applied to support humane and ethical treatment of animals through technological innovation. In conclusion, the proposed IoT-based environment monitoring system offers a sustainable and impactful solution for improving domestic animal shelter standards and sets a foundation for future expansions, including predictive analytics, automated alerts, and integration with veterinary health records. In the future, this kind of prototype can also become self powered by modifying the power utilization through the solar cell, and the sensor can also be used on the basis of industry standards.

## REFERENCES

- [1] M. Pillewan, R. Agrawal, N. Wyawahare and L. Thakare, "Development of Domestic Animals Shelter Environment Monitoring System using Internet of Things (IoT)," 2023 International Conference on Sustainable Computing and Smart Systems (ICSCSS), Coimbatore, India, 2023, pp. 972-976, doi: 10.1109/ICSCSS57650.2023.10169332.
- [2] R. Arthi., S. Nishuthan and L. Deepak Vignesh, "Smart Agriculture System Using IoT and ML," 2023 International Conference on Signal Processing, Computation, Electronics, Power and Telecommunication (IconSCEPT), Karaikal, India, 2023, pp. 1-6, doi: 10.1109/IconSCEPT57958.2023.10170555
- [3] M. R. Devi, V. Jyothi and D. Nagajyothi, "IoT and Cloud-based Automated Pet CareSystem,"2022 6th International Conference on Electronics, Communication and Aerospace Technology, Coimbatore, India, 2022, pp. 1366-1372, doi:10.1109/ICECA55336.2022.10009347.
- [4] P. N. Vrishanka, P. Prabhakar, D. Shet and K. Rupali, "Automated Pet Feeder using IoT,"2021 IEEE International Conference on Mobile Networks and Wireless Communications (ICMNWC), Tumkur, Karnataka, India, 2021, pp.1-5, doi:10.1109/ICMNWC52512.2021. 9688391.
- [5] Pillewan, M., Agrawal, R., Wyawahare, N. and Thakare, L., 2023, February. Review on Design of Smart Domestic Farming based On Internet of Things (IOT). In 2023 Third International Conference on Artificial Intelligence and Smart Energy (ICAIS) (pp. 36-40). IEEE.
- [6] Shende, D., Wyawahare, N., Thakare, L. and Agrawal, R., 2023, February. Design Process for Adaptive Spraying of Pesticides Based on Mutual Plant Health Detection and Monitoring: A Review. In 2023 Third International Conference on Artificial Intelligence and Smart Energy (ICAIS) (pp. 729-733). IEEE.
- [7] Deotale, Priyanka, and Prasad Lokulwar. "Smart Crop Protection System from Wild Animals Using IoT." In 2021 International Conference on Computational Intelligence and Computing Applications (ICCICA), pp. 1-4. IEEE, 2021.
- [8] Yadav, P., Chandra, S., Kumar, P. and Kumar, P.,

2021. Digital Farming: IoT Enabled Smart Sensor Based Insect and Animal Detection System. *Int. J. of Aquatic Science*, 12(2), pp.2564-2573.
- [9] Deepa, S., H. Vitur, K. Navaneeth, and S. Vijayrathinam. "Animal monitoring based on IoT technologies." *Waffen-und Kostumkunde Journal* 11 (2020): 332-336.
- [10] Karthick, G.S., Sridhar, M. and Pankajavalli, P.B., 2020. Internet of things in animal healthcare (IoT AH): review of recent advancements in architecture, sensing technologies and real-time monitoring. *SN Computer Science*, 1, pp.1-16.
- [11] Gawali, D. S., D. Taware Jyoti, Khartode Shital, and Khapale Priyanka. "IoT Based Food Management and Environmental Change in Cattle Shelter." *international journal* 4, no. 2 (2019).
- [12] Mhaisen, N., Abazeed, O., Al Hariri, Y., Alsalemi, A. and Halabi, O., 2018, August. Self-Powered IoT-Enabled Water Monitoring System. In *2018 International Conference on Computer and Applications (ICCA)* (pp. 41-45). IEEE.
- [13] Caria, M., Schudrowitz, J., Jukan, A. and Kemper, N., 2017, May. Smart farm computing systems for animal welfare monitoring. In *2017 40th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO)* (pp. 152-157). IEEE.
- [14] Memon, M.H., Kumar, W., Memon, A., Chowdhry, B.S., Aamir, M. and Kumar, P., 2016, March. Internet of Things (IoT) enabled smart animal farm. In *2016 3rd International Conference on Computing for Sustainable Global Development (INDIACom)* (pp. 2067-2072). IEEE.
- [15] Choukidar, G. A., & Dawande, N. A. (2017). "Smart Poultry Farm Automation and Monitoring System." *International Conference on Computing, Communication, Control and Automation (ICCUBEA)*, pp. 1–5.
- [16] Gunawan, T. S., Sabar, M. F., Nasir, H., Kartiwi, M., & Motakabber, S. M. A. (2019). "Development of Smart Chicken Poultry Farm using RTOS on Arduino." *IEEE International Conference on Smart Instrumentation, Measurement and Application (ICSIMA)*, pp. 1–5.
- [17] Hambali, M. F. H., Patchmuthu, R. K., & Wan, A. T. (2020). "IoT Based Smart Poultry Farm in Brunei." *8th International Conference on Information and Communication Technology (ICOICT)*, pp. 1–5.
- [18] Lashari, M. H., Memon, A. A., Shah, S. A. A., Nenwani, K., & Shafqat, F. (2018). "IoT Based Poultry Environment Monitoring System." *IEEE International Conference on Internet of Things and Intelligence System (IOTAIS)*, pp. 1–5.
- [19] Mondol, J. P., Mahmud, K. R., Kibria, M. G., & Al Azad, A. K. (2020). "IoT based smart weather monitoring system for poultry farm." *2nd International Conference on Advanced Information and Communication Technology (ICAICT)*, pp. 229–234