An overview of the literature on the use of AI and ML enabled IoT in the management of poultry health and welfare

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Abstract - Advent of AI and role of the latest technologies in poultry farming can revolutionize it. Yet its full potential need to be realized. Artificial Intelligence is essential to computer science because it makes it possible to create intelligent computers that can carry out jobs that normally call for human intelligence. AI and sensors are employed in the poultry sector to evaluate and improve the ventilation system, guaranteeing a comfortable atmosphere for the birds. It can be used to collect data on a range of topics related to poultry houses including behavior, health, microenvironment and movement. By examining this data, the AI system can identify abnormalities and swiftly adjust. It can also help to measure the moisture content of the litter, among other things. It may also evaluate environmental factors, poultry health and equipment malfunctions. AI integration optimises performance and production in commercial poultry farms by regulating machinery and equipment based on gathered data. This allows for automatic equipment management. This paper highlights how AI and ML enabled IoT application can play an important role in Precise Livestock Farming and welfare of livestock.

Keywords: **Poultry, Artificial Intelligence, Sensors, Microenvironment, Machine Learning, Internet of Things.**

I. INTRODUCTION

According to the 20th livestock census, India is the third-largest producer of eggs in the world, turning out an astounding 82.93 billion eggs. It also comes in fifth place for producing grill meat, creating about 4.4 metric tonnes. At over 70,000 crores in Indian rupees, the poultry sector makes a significant economic contribution to the country and will only get bigger as the economy expands (20th livestock census, 2019) [1]. The quantity of chickens produced has more than doubled from 1989 to 2019, reaching 25.9 billion in 2019, before COVID-19 pandemic. With 13.3 million tonnes produced in 2019, Poland led the European Union in the production of chicken meat, accounting for 9% of global exports. With 1.5 million tonnes exported, Poland was among the top exporters worldwide. Poland produced 2.6 million tonnes of poultry meat [2].

The creation of computer systems with the ability to carry out tasks that normally require human intelligence is known as artificial intelligence (AI) [3] e.g. Understanding natural language, identifying patterns, resolving issues, drawing lessons from past mistakes and creating choices [4]. AI systems often rely on algorithms and data to simulate human cognitive functions. A branch of artificial intelligence called machine learning uses massive datasets to train computers to find patterns and automatically generate predictions and conclusions. Deep learning is a branch of machine learning that processes data hierarchically using multiple-layer neural networks. It frequently produces state-of-the-art performance in applications like speech and image recognition [5].

AI technologies have numerous applications across various domains, including:

- Natural Language Processing (NLP): AI systems can understand, interpret and generate human language, enabling applications such as chatbots, virtual assistants and language translation tools.
- Computer Vision: AI algorithms can analyze and interpret visual data, allowing for applications like facial recognition, object detection and autonomous vehicles.
- Robotics: AI enables robots to perceive their environment, make decisions and perform tasks autonomously or semi-autonomously, leading to applications in manufacturing, healthcare and exploration.
- Healthcare: AI can assist in medical diagnosis, drug discovery, personalized

treatment plans and monitoring patient health.
- Finance: AI algorithms are used for fraud detection, algorithmic trading, risk assessment and customer service in the financial sector.
- Education: AI-based systems can personalize learning experiences, provide tutoring or coaching and automate administrative tasks for educators.
- Gaming: AI powers non-player characters (NPCs) in video games, enabling dynamic and adaptive gameplay experiences.
- Automated Decision Making: AI systems can analyze data and make decisions faster and more accurately than humans in various domains, such as business, logistics and cybersecurity.

However, AI also raises ethical, societal and economic concerns including job displacement due to automation, biases in algorithms, privacy issues and the potential for misuse or abuse of AI technologies. Thus, responsible development and deployment of AI are crucial to ensure its benefits are maximized while minimizing potential risks.
There are many ways with the latest development in Artificial Intelligence and Machine Learning technology is contributing in Poultry farming. Be it temperature monitoring in bird shed or feed level monitoring, different gaseous level like ammonia and carbon dioxide level or with the help of bio-sensors, disease prevention technology. It is helping in many ways poultry farming. Its adoption is not quite challenging like old days [6]. The other way AI can help a poultry farmer or an inspiring poultry farmer is providing a Generative AI based conversant agent which answers all the queries of a poultry farmer 24X7 throughout the year. It will help poultry farmer to approach poultry farming in a scientific and informed way. Queries may range from simple things like feed related and to more experts one like vaccination and disease management.

II. Artificial Intelligence and Machine Learning in Poultry Industry

Artificial intelligence (AI) has several applications in the poultry industry aimed at improving efficiency, productivity and animal welfare. Some key areas where AI is being utilized in poultry farming include [7]:
- Monitoring and Management: AI-powered systems can monitor various aspects of poultry farming including temperature, humidity, air quality, water consumption and feed intake. Sensors and cameras collect data which is then analyzed by AI algorithms to detect abnormalities or patterns that may indicate health issues or environmental problems. This proactive monitoring helps farmers identify and address issues promptly, thereby improving overall flock health and productivity [8].
- Predictive Analytics: AI algorithms can analyze historical data on factors such as weather patterns, feed composition and disease outbreaks to predict future trends and optimize farm management practices. For example, predictive analytics can help farmers anticipate fluctuations in egg production, adjust feed formulations and implement disease prevention measures preemptively.
- Precision Livestock Farming: AI enables precision livestock farming techniques where individual animals are monitored and managed based on their specific needs and behaviors. For instance, computer vision systems can identify and track individual birds, allowing for personalized feeding strategies and early detection of health problems. This individualized approach helps optimize resource allocation and minimize waste while improving animal welfare [2] .
- Disease Detection and Diagnosis: AI algorithms can analyze data from various sources, such as sensor readings, images and molecular diagnostics to detect signs of disease in poultry flocks. Machine learning models trained on large datasets of healthy and diseased birds can identify subtle

changes in behavior, physiology and appearance that may indicate the presence of illness. Early detection of diseases allows farmers to implement targeted interventions, such as quarantine measures or treatment protocols, to prevent the spread of infection and minimize economic losses [9].

- Supply Chain Optimization: AI-driven supply chain management systems can optimize the distribution of poultry products from farm to market. By analyzing factors like demand forecasts, transportation costs, inventory levels and market prices, AI algorithms can recommend the most efficient routes and schedules for transporting poultry products, reducing transportation costs and minimizing spoilage.

Overall, AI has the potential to revolutionize the poultry industry by enabling data-driven decision-making, proactive management practices and personalized care for individual animals. However, it's essential to address challenges such as data privacy, algorithm bias and the ethical implications of AI use to ensure its responsible and beneficial implementation in poultry farming.

III. Farm Management

Farm management in poultry involves overseeing various aspects of poultry farming operations to ensure the health and productivity of the flock while maximizing profitability [10]. Here are some key elements of farm management in poultry.

A. Housing and Infrastructure

Proper housing is essential for the well-being of poultry. Farm managers need to ensure that poultry houses are well-ventilated, properly insulated and equipped with adequate lighting and heating systems. They also need to design the layout of the housing facilities to optimize space utilization and minimize the risk of disease transmission.

B. Nutrition and Feeding

Farm managers are responsible for formulating and implementing appropriate nutrition and feeding programs for the poultry flock. This includes selecting the right feed formulations, monitoring feed consumption and adjusting diets based on factors such as age, breed, and production goals. Additionally, managers must ensure that feed storage facilities are clean, dry and free from pests to maintain feed quality.

C. Health Management

Preventing and controlling diseases is crucial in poultry farming. Farm managers need to develop and implement biosecurity protocols to minimize the risk of disease introduction and transmission. This includes practices such as limiting visitors, disinfecting equipment and monitoring flock health regularly. Managers also need to work closely with veterinarians to develop vaccination programs and implement disease surveillance measures.

D. Breeding and Genetics

Farm managers may be involved in selecting breeding stock and managing breeding programs to improve traits such as growth rate, egg production and disease resistance. This involves tracking performance metrics, such as hatch rates and feed conversion ratios, and making breeding decisions based on genetic potential and production goals.

E. Egg Production

In layer operations, farm managers oversee egg production, collection, grading and packaging processes to ensure the quality and safety of eggs.

F. Data Management and Record Keeping

Effective farm management relies on accurate record-keeping and data analysis. Farm managers need to maintain records of flock performance, health status, feed usage and production costs. Analyzing this data allows managers to identify trends, make informed decisions and optimize farm operations for efficiency and profitability.

G. Labor Management

Managing labor resources effectively is essential for efficient farm operations. Farm managers need to recruit, train and supervise farm workers, assigning tasks and responsibilities as needed to ensure smooth operation of the farm.

H. Regulatory Compliance

Farm managers must comply with local, state and federal regulations governing poultry farming, including environmental regulations, animal welfare standards and food safety requirements. Staying informed about regulatory changes and implementing appropriate measures to meet compliance standards is essential.

By effectively managing these aspects of poultry farming, farm managers can optimize production efficiency, maintain flock health and welfare and ensure the sustainability and profitability of their operations. By deploying IoT sensors in poultry shed temperature, humidity, ammonia and feed supply can be monitored 24X7 through-out the year. Installing cameras help to monitor the well-being of the birds [10].

IV. HATHERY MANAGEMENT

In hatcheries, managers are responsible for incubation, hatching and chick care procedures, maintaining optimal conditions for embryo development and chick health. A typical hatchery requires to maintain temperature, humidity and carbon dioxide level all around the clock throughout the hatching period. If manual intervention is required, this becomes a cumbersome process. With the help of environmental sensors and IoT, these challenging tasks are very easy to perform and no manual intervention is required. In case of critical conditions arising in hatchery, an alarm is raised. Also, data is stored 24X7 on the cloud and can be accessed at any point of time. IoT helps to monitor hatchery conditions on mobile devices with internet connections or on any desktop/laptop sitting in any office. Data can be downloaded at any point when required and big data analysis can be done it which was not possible when reading is on paper or spreadsheet in lying in disparate system distributed over multiple locations [10].

V. DISEASE MANAGEMENT

Disease management in poultry farming is essential for maintaining flock health, preventing outbreaks, and minimizing economic losses [11]. Here are some key strategies and practices involved in disease management.

A. Biosecurity Measures

Implementing strict biosecurity protocols is critical to prevent the introduction and spread of diseases on poultry farms. This includes controlling access to the farm, disinfecting equipment and vehicles, limiting visitors and separating different production areas to prevent cross-contamination. Biosecurity measures also involve proper hygiene practices such as handwashing and wearing dedicated farm clothing and footwear.

B. Vaccination Programs

Vaccination is an essential tool for preventing infectious diseases in poultry. Farm managers work closely with veterinarians to develop vaccination schedules tailored to the specific disease risks and production goals of the flock. Vaccination programs typically target common diseases such as Newcastle disease, infectious bronchitis, Marek's disease and avian influenza.

C. Disease Surveillance

Regular monitoring and surveillance are essential for early detection of diseases on poultry farms. Farm managers should implement surveillance programs to monitor flock health including routine physical examinations, laboratory testing of samples (such as blood, feces, or swabs) and monitoring of mortality rates and clinical signs. Early detection allows for prompt intervention and control measures to prevent the spread of disease.

D. Quarantine and Isolation

When a disease outbreak occurs or when introducing new birds to the flock, farm managers may implement quarantine and isolation measures to prevent the spread of disease. Quarantine involves isolating sick or potentially infected birds from the rest of the flock, while isolation separates new or potentially exposed birds until they can be evaluated for signs of disease.

E. Sanitation and Cleaning Protocols

Maintaining clean and sanitary conditions is essential for disease prevention. Farm managers should establish regular cleaning and disinfection protocols for poultry housing, equipment, feeders and waterers. Removing organic matter and disinfecting surfaces helps eliminate pathogens and reduces the risk of disease transmission.

F. Integrated Pest Management

Pests such as flies, rodents and wild birds can serve as vectors for disease transmission on poultry farms. Implementing integrated pest management strategies such as proper waste management, sealing entry points and using traps or repellents helps reduce the risk of pest-related disease transmission.

G. Nutritional Management

Proper nutrition plays a crucial role in supporting the immune function and overall health of poultry. Farm managers should ensure that birds receive balanced diets formulated to meet their nutritional requirements at each stage of growth and production. Malnutrition can weaken the immune system and make birds more susceptible to diseases.

H. Prompt Veterinary Care and Treatment

Farm managers should establish a relationship with a veterinarian who specializes in poultry health. Prompt veterinary care is essential for diagnosing and treating diseases effectively. Veterinarians can provide guidance on disease management strategies, prescribe medications when necessary and assist with disease control measures.

By implementing these disease management practices, poultry farmers can reduce the risk of disease outbreaks, protect flock health and maintain the productivity and profitability of their operations. Additionally, ongoing education and training for farm staff are essential to ensure that disease management protocols are consistently followed. Wireless devices equipped with accelerometers and body temperature sensors have been utilized under closely watched experimental conditions to identify highly pathogenic avian influenza-infected chicks up to six hours before they die [12]. Later, the same research team developed more advanced equipment using a radial lead thermistor and a wireless 3-axis accelerometer. This improved system sent activity and temperature data to wireless sensor nodes to facilitate the early detection of avian influenza symptoms [13]. With a 100% detection ratio, this technique demonstrated the capacity to identify abnormal states caused by the illness twice as early as compared to using body temperature sensors alone.

Such sensing technology could be useful on a subpopulation of sentinel birds, acting as a prophylactic or early detection technique, especially in high-risk areas, albeit it might be difficult to apply in big poultry flocks. Furthermore, as changes in temperature and a decrease in activity level are frequent general indicators of a number of illnesses, this straightforward apparatus might also function as a warning system to identify additional possible health hazards.

Table 1: IoT and ML for insights on poultry diseases

IoT devices	Algorithms	Measures	Purpose	Reference
Cameras	BiL STM	Sound, images	Determine the respiratory issue	Cuan *et al.* (2022)[14]
RFID/Historical	DNN	Time, target weight, weight in real time, and feed input	Identify non-laying birds	You *et al.* (2021)[15]
Acoustic box	SVM	Sound	Determine the respiratory issue	Mahdavian *et al.* (2021)[16]
cameras, sensors	RF	soil/feces sample, temperature, relative humidity, and wind speed	Salmonella prevalence	Hwang *et al.* (2020)[17]
Microphones	RNN, CNN	Sound, swab samples	Determine the respiratory issue	Cuan *et al.* (2020)[18]
Historical data	RF, ME	Location, species and number of broilers, virus subtypes	Determine the respiratory issue	Belkhiria *et al.* (2020)[19]
Cameras	CNN	Chicken images, feather texture, postures	Determine the respiratory issue	Zhuang and Zhang (2019)[20]
Cameras, Sensors	kNN, SVM, Logistic, DT	Image and sound of chickens	Determine the respiratory issue	Raj and Jayanthi (2019)[21]
Historical data	SVM, BN, kNN	isolations of avian influenza	Determine the respiratory issue	Qiang and Kou (2019)[22]
cameras, sensors	ANN, Logistic, SVM	posture and movement patterns	Determine the respiratory issue	Okinda *et al.* (2019)[23]
Microphones	SVM	Chicken sound	Determine the respiratory issue	Huang *et al.* (2019)[24]
Sensors	RF, GBM	soil/feces sample, temperature, relative humidity, and wind speed	Listeria spp prevalence	Golden *et al.* (2019)[25]
Sensors	Logistic, ANN	RNA microarray	Determine the respiratory issue	Fang (2019)[26]
Microphones	LD	Sneezing noises	Detect sneezing in chickens	Carpentier *et al.* (2019)[27]
Cameras	SVM	Postures	Determine the respiratory issue	Zhuang *et al.* (2018)[28]
Sensors, cameras	kNN	Temperature; humidity; HN3; motions	Determine the respiratory issue	Raj and Jayanthi (2018)[29]
Historical data	Association rule; SPM	Farm, city, kind of bird, quantity of birds	Determine the respiratory issue	Xu *et al*. (2017)[30]
Cameras	SVM	The image of chicken excrement	Determine the respiratory issue	Aziz and Othman (2017)[31]

VI. Trials and Evaluation of Nutrition and Medicinal Products

Artificial intelligence (AI) is incredibly effective in collecting and analysing data, particularly in the context of comparative product trials. Many data points can be monitored by machines and sensors at once, a task that would take a lot of time for humans to complete. In addition to collecting data, artificial intelligence (AI) facilitates the analytics process by giving results that are comparable and backed by statistical analysis. AI also expedites the assessment of the effects of various feed formulations, a task that is nearly impossible for humans to complete at such a rapid pace. AI-enabled robotics and programming help to improve breed genetics by detecting traits shared across breeds and streamlining selection process decision-making. These programs guarantee accurate findings while cutting trial costs dramatically. With AI's capabilities, the expensive process of research and development (R&D) in any industry may be managed effectively. AI enables businesses to carry out several research in a single trial, an accomplishment that would often require a large amount of human labor. To sum up, AI's abilities in data gathering, processing, and analytics significantly improve the effectiveness and financial viability of trials, comparative analyses, and research and development in the chicken sector. It facilitates improved decision-making, produces accurate results and streamlines procedures, all of which contribute to a major improvement in the methods used in chicken farming.

VII. Environmental Monitoring

Environment monitoring in poultry farming is crucial for maintaining optimal conditions to ensure the health and well-being of the birds and maximize production efficiency [32]. Here are some key aspects of environment monitoring in poultry.

A. Temperature Control

Poultry are sensitive to temperature fluctuations. Monitoring and controlling temperature levels within the poultry house is vital to prevent stress and health issues. Temperature sensors placed strategically throughout the facility can provide real-time data to ensure the temperature remains within the recommended range.

B. Humidity Monitoring

Maintaining proper humidity levels is essential for preventing respiratory issues and promoting bird comfort. High humidity levels can also contribute to the growth of harmful pathogens. Humidity sensors can help monitor and regulate humidity levels within the poultry house.

C. Ventilation Management

Proper ventilation is critical for maintaining good air quality by removing excess moisture, gases (such as ammonia) and airborne pathogens. Monitoring ventilation systems and ensuring proper air exchange rates can help maintain optimal indoor air quality [33].

D. Lighting Control

Lighting plays a significant role in poultry production, influencing bird behavior, growth rates and reproduction. Monitoring lighting schedules and intensity can help regulate bird activity and optimize production outcomes.

E. Air Quality Monitoring

Monitoring air quality parameters such as ammonia levels, dust particles and carbon dioxide concentrations can help identify potential health hazards and ensure a healthy environment for the birds.

F. Water Quality Monitoring

Clean water is essential for poultry health and productivity. Monitoring water quality parameters such as pH, temperature and bacterial contamination can help ensure that the water provided to the birds is safe and of high quality.

G. Feed Management

Monitoring feed consumption patterns and feed distribution systems can help ensure that birds have access to an adequate and balanced diet, optimizing growth and production outcomes.

H. Disease Surveillance

Regular monitoring for signs of disease, as well as implementing biosecurity measures, is crucial for preventing and controlling the spread of infectious diseases within the poultry flock.

I. Data Analysis and Management

Collecting and analyzing data from various monitoring systems can provide valuable insights into environmental conditions, bird health and production performance. Implementing data management systems can help streamline data collection and analysis processes, enabling timely decision-making and proactive management strategies.

Overall, comprehensive environment monitoring in poultry farming is essential for promoting bird welfare, optimizing production efficiency and ensuring sustainable and profitable poultry operations [34].

VIII. Analysis of Sound

Analyzing sound in poultry farming can provide valuable insights into the health, behavior and welfare of the birds [35]. Here are some aspects of sound analysis in poultry.

A. Vocalizations

Chickens, like many other animals, produce vocalizations that convey information about their well-being, social interactions and environmental conditions. Monitoring the frequency, intensity and patterns of vocalizations can help detect signs of distress, agitation or disease within the flock [36].

B. Alarm Calls

Some poultry species, such as chickens, may emit specific alarm calls in response to perceived threats or disturbances. Analyzing alarm calls can provide early warning signs of potential risks or stressors in the environment, allowing farmers to take appropriate action to mitigate them.

C. Activity Levels

The sound of poultry moving, feeding or engaging in other behaviors can indicate their activity levels and overall welfare. Changes in the frequency or intensity of activity-related sounds may signal shifts in behavior or health status that require further investigation.

D. Environmental Noise

Monitoring ambient noise levels within the poultry house can help assess the overall acoustic environment and identify sources of stress or discomfort for the birds. Excessive noise from equipment, ventilation systems or external sources can negatively impact bird behavior and productivity.

E. Health Monitoring

Sound analysis can be used as a non-invasive method for monitoring the respiratory health of poultry. Abnormal respiratory sounds, such as wheezing or coughing, may indicate respiratory infections or other health issues requiring veterinary attention.

F. Social Interactions

Poultry are social animals that engage in various forms of vocal communication during social interactions, such as mating displays, dominance displays or establishing territorial boundaries. Analyzing social vocalizations can provide insights into the dynamics of social hierarchy and group cohesion within the flock.

G. Stress Assessment

Changes in the frequency, duration or intensity of vocalizations can serve as indicators of stress or discomfort in poultry. Monitoring vocalization patterns over time and correlating them with other physiological or behavioral parameters can help assess the overall stress level within the flock.

H. Automated Monitoring Systems

Advancements in technology have led to the development of automated sound monitoring

systems that use machine learning algorithms to analyze poultry vocalizations in real-time. These systems can provide continuous monitoring of bird vocalizations and alert farmers to potential issues or abnormalities.

Overall, sound analysis in poultry farming offers a non-invasive and informative approach to monitoring bird health, behavior and welfare. By leveraging sound as a diagnostic tool, farmers can proactively identify and address issues within the flock, ultimately promoting better outcomes for both the birds and the farm operation.

IX. Key challenges in poultry welfare management

Poultry welfare management faces several challenges, stemming from various factors including economic pressures, consumer expectations and the complexities of modern production systems. Some of the key challenges in poultry welfare management include:

A. Intensive Production Systems

Most poultry production occurs in intensive systems where large numbers of birds are housed in confined spaces. These systems can present challenges in providing adequate space, ventilation and environmental enrichment, leading to issues such as overcrowding, poor air quality and limited opportunities for natural behaviors.

B. Cage Systems for Egg Production

The use of conventional cage systems for egg-laying hens has been widely criticized for its limitations on natural behaviors such as perching, nesting and dust bathing. Transitioning to alternative housing systems such as enriched colony cages, cage-free systems or free-range systems presents logistical and economic challenges for producers.

C. Health and Disease Management

Disease outbreaks can have significant welfare implications for poultry flocks. Managing diseases such as avian influenza, Newcastle disease and infectious bronchitis requires vigilant biosecurity measures, vaccination programs and prompt veterinary intervention. However, implementing effective disease management strategies can be challenging, particularly in large-scale production systems.

D. Physical Health Issues

Certain production practices, such as selective breeding for fast growth or high egg production, can lead to physical health issues in poultry. Rapid growth rates in broiler chickens can result in musculoskeletal problems such as leg disorders and heart issues. Similarly, high egg production rates in laying hens can lead to osteoporosis and reproductive disorders.

E. Beak Trimming and Other Husbandry Practices

Beak trimming is a common practice in poultry farming to reduce feather pecking and cannibalism in crowded conditions. However, it is a controversial practice that can cause pain and compromise welfare if not performed correctly. Similarly, other husbandry practices such as dubbing (removal of comb and wattles) and toe trimming may raise welfare concerns if not conducted with proper care.

F. Transport and Slaughter

The transportation and slaughter of poultry can be stressful for birds, potentially leading to welfare issues such as heat stress, fatigue and injury. Ensuring proper handling, transportation conditions and humane slaughter practices are essential for minimizing stress and ensuring humane treatment throughout the process.

G. Consumer Awareness and Expectations

There is growing consumer awareness and concern about animal welfare in food production including poultry farming. Meeting consumer expectations for higher welfare standards while balancing economic considerations can be challenging for producers.

H. Regulatory Compliance and Enforcement

While regulations and guidelines exist to protect poultry welfare, enforcement mechanisms may vary and compliance can be challenging to monitor effectively, particularly in large-scale

production systems or in regions with limited resources.

X. Future Aspects

We need a centralized system for "Optimization of Temperature, Humidity, CO_2 and NH_3 in a closed environment" for smooth operation and energy saving. With help of centralized system, different aspects of a farm and hatchery can monitored with ease and less manual intervention. If we can get rid of manual intervention in the entire process with help of automated system, entire farm and Hatchery management will be very cost efficient and easy to manage. Moreover, production can also be increased manifold.

XI. Conclusion

An extensive and methodical analysis of the uses of AI and IoT in managing the health and welfare of poultry, particularly for chicken production, has been presented in this paper. The most recent uses of AI-enabled IoT were also demonstrated, utilising a number of typical studies that highlighted the data, hardware and software components utilised in poultry welfare systems as well as processing methods. Furthermore, this study provided a solid, dependable and adaptable framework for poultry welfare, particularly in terms of achieving strong poultry disease outbreak control and it demonstrated the important role of IoT/AI interventions in poultry. By assisting stakeholders in comprehending and utilising cutting-edge digital technologies more effectively and in critically analysing the constraints of poultry farms in identifying potential uses and trends of technological advancements in the industry, this study improves knowledge. Additionally, knowledge about technology for managing the welfare of chickens and streamlining their production process would make it easier to produce chickens at a cheap cost, high quality and speed. As a result, the evaluation will provide fresh ideas that boost profitability and production in the chicken farming sector preventing the spread of poultry diseases.

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