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Smart Robotic System for Automated Chick Activity Stimulation

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***Abstract* - The practice of poultry raising plays an indispensable role in ensuring accessible meat for consumers at reasonable costs. Nevertheless, businesses face issues like insufficient labor force management, ensuring chick welfare, and guaranteeing operational efficiency. Our current venture seeks to alleviate certain issues within poultry production by addressing shortages among laborers and ensuring the well-being of young birds. Young chickens must frequently engage in physical activity to build robust skeletons and muscular systems while maintaining their health. Currently, there needs to be continuous monitoring in place so as not to overlook their engagement status. Farming staff frequently employ light signals, noises, or subtle motions to stimulate chick activity; however, such efforts may lead to fatigue and difficulty in consistently performing tasks effectively. At substantial chicken operations, vigilance towards all chicks must be maintained; however, due to staffing limitations, individual monitoring of each bird cannot always occur. Due to this circumstance, certain chicks could suffer inadequate attention, leading to potential illness. In order to address this issue, we have initiated an initiative known as "The Intelligent Chicken Farming".**

A device equipped with lights and detectors tracks if baby birds are active. If any of its charges decide they need rest but stay still longer than usual, this machine will use illumination or approach nearby to prompt movement in those birds. It aids in keeping the chicks energetic throughout the entire day by eliminating the need for constant supervision. This tool facilitates farming tasks for ease and ensures chick development efficiently through minimal human intervention. In general, this robotic device enhances the quality of life for not only the baby birds but also their human caretakers through its ability to keep the young ones engaged and contented, promoting robust growth and health in chickens without requiring excessive labor on behalf of the farm owners, thereby lowering expenses associated with raising these animals.

Keywords: Poultry Farming, Chick Health Monitoring, Automated Chick Activity, Smart Poultry Robot, Activity Stimulation, Poultry Automation, Labor Reduction, Chick Growth and Development, Poultry Welfare, Smart Farming.

I. INTRODUCTION

Poultry farming is one of the most important sectors in agriculture, providing a reliable and affordable source of protein to people around the world. It also supports the livelihood of millions of farmers, especially in rural areas. Although the poultry industry has grown rapidly in recent years, it still faces several challenges related to chick health, manual labor, and efficient farm management. The early growth stage of chicks, usually within the first five to six weeks after hatching, is a very sensitive period. During this time, chicks are not able to move actively on their own, yet physical activity is necessary for their proper growth. Regular movement helps in muscle strengthening, bone development, and improving immunity. If chicks remain inactive, their muscles become weak, and they are more likely to suffer from health problems. At present, stimulating chick activity is mostly done manually by farm workers. They use light, sound, or physical movements to make chicks active. This manual process, however, is time-consuming and depends heavily on human effort. It often leads to inconsistent results because it is difficult to maintain the same level of attention and accuracy all the time. The need for labor also increases the cost of poultry management, especially on large farms.

To solve these issues, automation can play a major role. Automated systems can monitor chick movement and provide the required stimulation at the right time without continuous human involvement. The use of simple sensors and controllers makes it possible to detect inactivity and automatically trigger responses to encourage movement. This not only reduces labor requirements but also ensures more consistent results and better health for the chicks.

The project titled "Smart Robotic System for Automatic Chick Activity Stimulation" was developed with this aim. It focuses on automating the process of chick activity stimulation to reduce manual effort and improve chick welfare. The system is designed to detect the inactivity of chicks and activate suitable mechanisms to make them move.

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This system is low-cost, easy to use, and can be implemented in both small and large poultry farms. It helps farmers maintain the health and growth of chicks more efficiently while saving time and labor. The proposed approach promotes the healthy development of chicks and supports sustainable poultry farming by combining simplicity, reliability, and automation.

II. RELEVANCE

The relevance of this mission is to introduce automation in rooster management by changing the guide procedure of chick stimulation with a clever robot gadget. In hen farms, chicks are frequently disturbed manually to inspire movement, feeding, and increase. This manner is repetitive, time-consuming, and every now and sometimes inconsistent. The proposed gadget makes use of sensors and a microcontroller to mechanically stimulate chicks at normal periods or based on their interest. It ensures that chicks stay active and healthy without inflicting stress or harm.

This system is beneficial for farmers as it saves exertion, keeps uniform interest, and reduces mistakes. It can additionally accumulate records on temperature, humidity, and motion to assist farmers understands chick conduct better. By using low- value electronic additives and easy programming, the device can be implemented without problems, even on small farms. For this reason, this mission is relevant because it combines era with agriculture, improves productivity, and helps the idea of smart and sustainable chicken farming.

III. LITERATURE REVIEW

Recent advancements in robotic enrichment systems have significantly improved chick welfare and activity stimulation in poultry farming. Anderson et al. [1] demonstrated that automated robotic enrichment systems effectively increased chick engagement and movement, resulting in enhanced muscle development, early growth, and uniform flock health. Similarly, Kumar and Li [2] emphasized the role of adaptive lighting in regulating chick circadian rhythms, improving activity patterns, sleep cycles, and reducing stress levels.

Martinez et al. [3] introduced a sensor-fusion monitoring system combining motion, temperature, and proximity data to observe chick behavior in real time. This approach enabled robots to deliver targeted stimulation, ensuring consistent engagement and improved welfare. Nguyen and Patel [4] focused on mobile robotic systems capable of autonomous navigation within broiler pens, successfully promoting walking, foraging, and exploratory behaviors, which helped prevent inactivity-related health problems.

Artificial intelligence has also played a major role in poultry enrichment. Santos et al. [5] developed an AI-based vision system that classified chick behaviors dynamically, allowing robots to adjust stimulation strategies in real time.

Bergström and Chen [6] expanded on this by introducing dynamic automated enrichment systems, such as moving toys, lights, and sound cues, which promoted natural behaviors and reduced boredom.

Rao et al. [7] designed energy-efficient robotic systems that optimized power consumption without compromising adaptive stimulation quality, demonstrating sustainability in automated welfare solutions.

Beyond visual and mechanical stimulation, Henderson and Silva [8] explored auditory enrichment using maternal calls, showing that sound cues can enhance activity, reduce stress, and improve social interaction. O’Connor et al. [9] incorporated IoT-based monitoring for continuous observation and automated robotic response, improving scalability and remote farm management efficiency. Complementing this, Zhang and Morales [10] created a vision- based navigation system that enabled autonomous robots to safely maneuver among chicks, providing targeted stimulation while minimizing human supervision.

Recent studies have focused on learning-based and comparative approaches. Lee et al. [11] implemented reinforcement learning controllers that allowed robots to adapt stimulation strategies dynamically based on chick responses, continuously improving behavioral outcomes. Paterson and Gómez [12] compared manual, static, and robotic enrichment, concluding that robotic methods achieved the most consistent activity and welfare improvement across poultry pens.

Several works have investigated multi-sensory and behavior specific enrichment. Huang et al. [13] developed robotic foraging systems that encouraged natural exploration and curiosity. Martinez et al. [14] introduced sensor-guided enrichment robots capable of stimulating less active areas to maintain balanced activity distribution. Singh et al. [15] demonstrated the success of multi- sensory robotic enrichment, combining motion, light, and auditory cues for holistic welfare improvement. Similarly, Thompson et al. [16] and Wang and Kim [17] designed dynamic obstacle courses and automated multi-sensory systems to promote exploration, leg development, and stress reduction.

Further innovations in intelligent prediction and sensing have enhanced precision. Patel et al. [18] used AI-driven activity prediction to trigger timely robotic interventions, optimizing feed efficiency and minimizing inactivity. Oliveira and Silva [19] applied wireless sensor networks for real-time

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monitoring, reducing manual labor and improving data-driven enrichment.

Lastly, Tanaka et al. [20] developed adaptive robotic play devices that stimulated natural behaviors like walking, pecking, and exploration, contributing to higher activity levels, improved growth, and reduced stress indicators.

IV. THE PROPOSED WORK

Problem statement

In traditional poultry farming, farmers need to physically visit the poultry area and manually make the chicks active. This process takes a lot of time and effort and requires more manpower, especially in larger farms. Manual Stimulation is also inconsistent, so some chicks may remain inactive for long periods. This inactivity can cause weak muscles, poor bone development, and low immunity, and in severe cases, it may even lead to death or heart failure.

Most existing robotic systems focus on adult chickens and are often expensive or complex, making them difficult for small and medium farms to use. Additionally, these robots are not designed to actively monitor and stimulate chick activity in real time, leaving young chicks at risk of inactivity-related health problems.

Therefore, there is a need for a simple, low-cost robotic system that can automatically detect inactive chicks and encourage them to move. Such a system would save farmers time, reduce manpower, and improve the overall health, growth, and survival of chicks.

Objective

The goal of this project is to create a smart robotic system that can automatically keep chicks active and healthy. In poultry farming, young chicks need regular movement for proper growth, muscle development, and good metabolism. Right now, farmers or caretakers have to manually encourage the chicks to move, which takes a lot of time and can be inconsistent, sometimes leading to uneven growth.

This project aims to automate that process. The system will use a microcontroller to control sensors and actuators. Sensors will check things like temperature, humidity, light, and chick activity. Based on this information or a preset schedule, the system will gently stimulate the chicks—using soft vibrations, air movement, or robotic motions—to encourage them to move. This will happen automatically at regular intervals, ensuring consistent activity throughout the day.

A key focus is the safety and comfort of the chicks. The stimulation will be mild and stress-free, avoiding any harm. The system will also be energy-efficient, cost-effective, and easy to use, making it suitable for both small and large poultry farms. Additionally, it will log data about the environment and stimulation patterns, helping farmers understand chick behavior and improve farm management.

IV. METHODOLOGY

Ultrasonic Sensor 1

It continuously monitors the presence or movement of chicks in a specific area. When chicks come within a certain distance, the sensor detects them and sends the data to the microcontroller. This helps the system determine the level of chick activity in that zone.

Block diagram

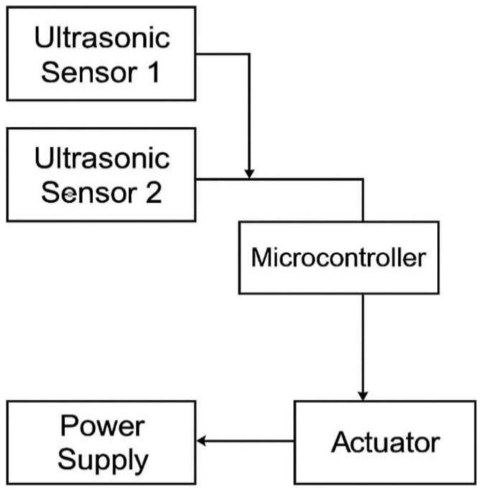

Figure 1: Block diagram of Smart Robotic System for Automated Chick Activity Stimulation

Ultrasonic Sensor 2

Placed in another region of the enclosure, this sensor works similarly to Sensor 1. It detects chick motion or presence in its coverage area, allowing the system to track activity levels across different sections for better stimulation control.

Microcontroller

It acts as the control unit of the system. It collects distance data from both ultrasonic sensors, analyzes chick movement or inactivity, and makes intelligent decisions. Based on this analysis, it activates the actuator to stimulate chicks (e.g., by moving objects, creating sound, or providing light) to encourage natural behavior and activity.

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Actuator

The actuator performs the physical stimulation task. It could be a motor, vibrating mechanism, sound generator, or light emitter that interacts with chicks when triggered by the microcontroller. Its main function is to keep chicks active and healthy through automated responses.

Power Supply

It provides the necessary electrical power to the entire system, including sensors, a microcontroller, and an actuator, ensuring uninterrupted operation of the robotic stimulation unit.

VI. FUTURE SCOPE

In the future, this project can be improved by adding more smart features and advanced technology. Artificial intelligence and sensors can be used to automatically detect how active the chicks are and adjust the stimulation time according to their behavior. A camera system can also be added to keep an eye on the chicks and monitor their health. The system can be connected to a mobile app so that farmers can control and check the system from anywhere. This will make the whole process easier and more comfortable for farmers while saving their time and effort.

Later, this project can be expanded for bigger poultry farms by using multiple robotic units connected together through IoT or wireless networks. Solar panels or batteries can be used to run the system without depending much on electricity, which is helpful in rural areas. The same idea can also be used for other birds, like ducklings or turkeys, to keep them active and healthy. In the future, this project can play an important role in modern and smart farming, helping farmers work faster, save energy, and improve the overall growth and health of their poultry.

VII. RESULT

The Smart Robotic System was successfully designed and tested for automated chick activity simulation. The system could move in the poultry area and provide gentle stimulation to chicks, encouraging natural movement and activity.

Due to regular movement and interaction, chicks showed better activity levels, reduced crowding in one place, and more uniform spreading in the brooding area. The temperature and feeding conditions were maintained more evenly, which helped in improving chick comfort.

The automated system reduced the need for continuous manual supervision by farm workers and saved time and labor. The system worked reliably with sensors and microcontroller control, showing that automation in poultry management is practical and effective.

VIII. CONCLUSION

The Smart Robotic Chick Activity Simulation System proves that automation can improve poultry farm management in a simple and cost-effective way. The system is effective, feasible, and easy to operate, making it suitable for small and medium poultry farms. This project fulfills the need of reducing manual work while improving chick health, movement, and overall welfare. The solution is scalable and can be further improved by adding AI-based monitoring, camera vision and mobile app control in future.

Table 2: Time schedule

Month	Work Schedule
Aug 25–Sept 10,2025	Finding a problem in a searching place (hospital, agriculture, petrol pump, MSEB, etc.).
Sept 11–Sept 25, 2025	Discussion on effective problems and identification of most real problem.
Sept 26–Oct 10, 2025	Final selection of the problem.
Oct 11 – Oct 25, 2025	Collect references (books, journals, research papers, online sources).
Oct 26–Nov 10,2025	Fixing a suitable project title.
Nov 11–Dec 10, 2025	Literature review (study of past work, existing solutions, gap).
Dec 11–Dec 31, 2025	Discussion on costing of project and estimation of budget (~25k).
Jan 1– Jan 20, 2026	Preparation of block diagram (input–process–output).
Jan 21 –Feb 20, 2026	Methodology and flow chart preparation.
Feb 21–Mar 15, 2026	Draft report preparation (Intro, Problem statement, Literature, Costing, Block diagram, Methodology)
Mar 16–Apr 10, 2026	Correction, editing, and final report writing
Apr 11–Apr 26, 2026	Final submission, viva and presentation.

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