Global Journal of Research in Engineering & Computer Sciences
ISSN: 2583-2727 (Online)
Volume 03| Issue 04 | July-Aug. | 2023
Journal homepage: https://gjrpublication.com/gjrecs/

Review Article

Construction of the Artificial Egg Incubator

[1] Mukhtar Ibrahim Bello, [2] Alhassan Bala, [3]Abdu Ibrahim Adamu, [4]Abdulkadir Shehu Bari, [5]Muhammad Ahmad Baballe*

[1]Department of Computer Science, Kano State Polytechnic, School of Technology, Kano, Nigeria.
[2,3,4]Department of Computer Science, Audu Bako College of Agriculture Danbatta, Kano, Nigeria.
[5]Department of Computer Engineering Technology, School of Technology, Kano State Polytechnic,Kano, Nigeria

Submission Date: 25 July 2023 | **Published Date:** 26 Aug. 2023

***Corresponding author:** Muhammad Ahmad Baballe
Department of Computer Engineering Technology, School of Technology, Kano State Polytechnic, Kano, Nigeria
ORCID: 0000-0001-9441-7023

Abstract

With the use of a spinning mechanism that aids in hatching the eggs, an egg incubator is a device that mimics bird incubation by keeping the eggs warm at a specific temperature range and in the proper humidity. A well-designed egg incubator system can achieve excellent hatchability and can hatch a huge number of birds at once. Sets of bulbs may make up the primary heating elements, which are used to heat the incubator so that the eggs can hatch. The microcontroller processed sensor data, and using machine language programming, it engaged various control devices to assist in controlling the incubator's conditions. An egg incubator that operates consistently, actively, and proficiently will typically be able to produce enough chicken to satisfy the daily protein needs of every household in the modern world.

Keywords: Fabrication, an egg, microcontroller, sensor, turning mechanism, and incubator.

I. Introduction

One of the most recent inventions that offers employment chances, particularly for people who aspire to be good farmers, is an egg incubator. The system for egg incubators is intended to automatically regulate the temperature and humidity of the incubator for various types of eggs. This egg incubator's primary function is to perform the animal's incubation of an egg till hatching. Since ancient times, both chicken and bird eggs have been incubated by artificial means. Artificial incubation techniques are said to have been invented by both the Chinese and the Egyptians. Both the global population and the demand for protein are currently expanding at alarming rates. A cheap and nutritious source of protein is poultry. A broody chicken (a chicken that desires to lay eggs, raise the chicks, and hatch the chicks) can often hatch 10–12 eggs at a time in three weeks, which reduces its output because it typically need time to incubate and hatch the chicks [1]. Some huge birds, including albatrosses and condors, typically lay just one egg every two years, according to Benjamin and Oye [2]. There is now a need for artificial incubation because relying on this kind of natural incubation is inadequate given the world's expanding population [3]. The steady temperature needed for an egg embryo to develop over a predetermined amount of time is the most crucial component of incubation. Another important factor is humidity; when the air around an egg is excessively dry during incubation, the egg will probably lose too much water to the atmosphere, which might make hatching difficult or impossible.

II. LITERATURE REVIEW

The minimum and maximum temperatures for the first eighteen days should be between 37.7 °C and 39.3 °C, according to Oluyemi and Roberts [4]. The temperature should be lowered from 37.8 °C to 36.0 °C after the eighteen days of incubation till the chicken's hatch. As of now, the temperature should be kept between 36°C and 39°C for the duration of incubation, in accordance with previous researchers' findings [4,5, 6, 7, 8, 9, 10, 11, 12, 13, 14]. However, Lourens et al. [15], King'ori [16], and Geneve [17] agreed that overheating the egg is much more important than underheating since it will help to accelerate the rate of growth, cause abnormal embryonic growth in the early stages, and reduce the percentage of hatchability. While operating the incubator at 35 °C for three to four hours will simply cause the chickens' metabolic rate to slow down, operating it at 41 °C for 15 minutes will negatively impact the

embryos [18]. A temperature increase of more than 40.5 °C is deadly [20]. Although a temperature reduction will delay hatching, it is less hazardous than an increase [20, 21]. The creation of chickens from an emergent embryo is a pretty delicate process that typically requires the right kind of supervision. According to Oluyemi and Roberts [4], the minimum and maximum humidity levels within eighteen days should be 52% and 62%, respectively. Komolafe et al. [22] also recommended these values. The relative humidity should increase from 55% to 71% after the first eighteen days till the incubation phase is complete. From this point forward, the relative humidity should fluctuate between 52% and 71% throughout the entire incubation period. In order to prevent the eggs from being in the same position every night—the longest time between turns—Wilson [23] recommended flipping the eggs more than three times a day. They should also be turned an odd number of times. Candling is also highly useful during incubation since it helps identify whether the embryo is growing. The seventh and fourteenth days of incubation are typically the dates for testing; occasionally, the testing is performed just once on the tenth day. Since the unhatched chicks need to relax and shouldn't be handled in the final few days, the eggs shouldn't be candled after the 18th day [24, 25].

III. USING THE ARTIFICIAL INCUBATION PROCESS AND ITS IMPACT

Below are some of the impacts of using the artificial incubation process

1. Some of the chickens can be hatched at a time in a short while.
2. Another advantage is that it is possible to plan when to hatch the chickens unlike with the hen one may not know when it can sit for the eggs.
3. Artificial incubation cannot spread diseases and parasites to the chickens and lastly, there is no cost for feeding a broody chicken since an incubator is used.
4. The Chances of the egg's spoilage are reduced since all the eggs are subjected to the optimum hatching temperatures.
5. There are no chances of the chicken damaging eggs through pecking, a common occurrence with natural incubation [25].

IV. DIFFICULTIES IN THE PROCESS OF ARTIFICIAL INCUBATION

Below are some challenges faced using the artificial incubation process

1. One of the disadvantages of artificial incubation is that it is expensive to buy an incubator. Most of the incubators are highly-priced and cannot be affordable to small-scale farmers. 2. Artificial incubation requires a lot of labor since there will be a lot of egg turning.
3. Artificial incubation requires many skills to maintain and manage the incubator.
4. The egg incubator needs a power source to work. In most of the rural and remote areas, a consistent source of power is the major challenge.
5. Artificial incubation has a high risk of damaging the embryo and it can encourage egg-breaking especially during egg turning.

V. FABRICATION OF THE ARTIFICIAL EGG INCUBATOR

Here are some pictures of the artificial egg incubator in use.

Fig. 1. The control box shows the power ON/OFF switch with the L.C.D. display.

Fig. 2. The construction of the whole egg incubator

Fig. 3. The switch that is responsible for increasing the temperature of the whole system also serves as the switch for powering the whole system if the switch is on from the control box

Fig. 4. Inside view of the whole system

Fig. 5. The internal view of the whole system if it is powered ON

Fig. 6. The trays that are used in hatching the eggs

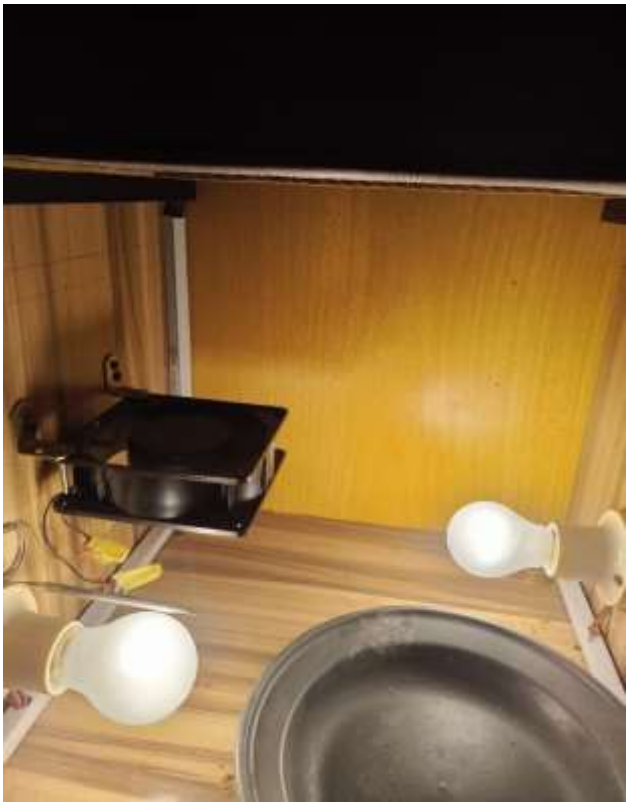

Fig. 7. The bulbs are used to provide heat to the system, while the fan is used to spray the heat across and also help in regulating the temperature of the whole system.

Conclusion

In this essay, we've examined the numerous technological developments in artificial egg incubators, their difficulties, and the results of their use. Additionally, the artificial egg incubation is a fiction.

References

1. K., M., French, Practical Poultry Revising. United States Peace Corps Information Collection Exchange Manual MOOH, Washington D.C., United States, pp 12-21, 1981.
2. N., Benjamin, N., D., Oye, Modification of the Design of Poultry Incubator. International Journal of Application or Innovation in Engineering 1: pp. 90-102, 2012.
3. F., Swainston, Get Slim Stay Naturally: The Herbal Guide to Permanent Weight Loss. Book tango Publisher, Liberty Drive, Bloomington, Illinois, United States pp. 140, 2014
4. J., A., Oluyemi, A., F., Roberts, Poultry Production in Warm Wet Climates Macmillan Publishers Limited, London and Basingstoke, United Kingdom, pp. 102, 1988.
5. W., I., Okonkwo, O., C., Chukwuezie, Characterization of a Photovoltaic Powered Poultry Egg Incubator. 4th International Conference on Agriculture and Animal Science IACSIT Press, Singapore 47: pp. 1-6. 2012.
6. N., Benjamin, N., D., Oye, Modification of the Design of Poultry Incubator. International Journal of Application or Innovation in Engineering 1: pp. 90-102, 2012.
7. K., L., Osanyinpeju, A., A., Aderinlewo, O., R., Adetunji, E., S., A., Ajisegiri, Performance Evaluation of a Solar Powered Poultry Egg Incubator. International Research Journal of Advanced Engineering and Science Volume 3 (2): pp. 255-264, 2018.
8. K., Kyimpong K, P., Forson, Design, and Construction of an Arduino Microcontroller-Based Egg Incubator. International Journal of Computer Applications 168 (1): pp. 15- 23, 2017.
9. N., T., Abraham, S., L., Mathew, C., A., P., Kumar, Design, and Implementation of Solar PV Poultry Incubator. International Journal of Engineering and Advanced Technology vol. 3 (3): pp. 289-291, 2014.
10. T., Suriwong, S., Banthuek, E., Singhadet, S., A., Jiajitsawat, New Prototype of Thermoelectric Egg Incubator Integrated with Thermal Energy Storage and Photovoltaic Panels. Maejo International Journal of Science and Technology vol. 11 (2): pp. 148-157, 2017.
11. B., O., Bolaji, Design, and Performance Evaluation of a Solar Poultry Egg Incubator. Thammasat International Journal Science Technology vol. 13 (1): pp. 47-55, 2008.
12. G., A., Ogunwande, E., O., Akinola, A., R., Lana, Development of a Biogas-Powered Poultry Egg Incubator. Ife Journal of Science vol. 17 (1): pp. 219-228, 2015.
13. T., A., Adegbulugbe, A., O., Atere, O., G., Fasanmi, Development of an Automatic Electric Egg Incubator,

International Journal of Scientific and Engineering Research vol. 4 (9): pp. 914-918. 2013.
14. M., F., Omar, H., C., M., Haris, M., N., Hidayat, I., Ismail, M., N., Seroji, Smart Eggs Incubator System. International Journal of Simulation, Science and Technology vol. 17 (41): pp. 1-7, 2016.
15. A., Lourens, H., Van den Brand, R., Meijerhof, B., Kemp, Effect of Eggshell Temperature during Incubation on Embryo Development, Hatchability and Post Hatch Development. Journal of Poultry Science vol. 84: pp. 914-920. 2005.
16. A., M., King'ori, Review of the Factors That Influence Egg Fertility and Hatchability in Poultry. International Journal of Poultry Science vol. 10 (6): pp. 483-492, 2011.
17. N., Geneve, Classroom Chick Hatch Program Guidebook. Nova Scotia Department of Agriculture, Bible Hill, Nova Scotia, Canada, North America, pp. 23. 2013.
18. E., S., Joseph, J., D., Michael, Helpful Hints for Teacher on Incubation and Embryology of the Chick. Cooperative Extension System, University of Connecticut Publisher, Mansfield, Connecticut, Storrs, USA pp. 20 pp, 2011
19. L., T., Egbeyale, O., M., Sogunle, Hatchery Technology, and Management. Lecture Handout. Federal University of Agriculture, Abeokuta, Ogun State, Nigeria pp. 24, 2009.
20. N., V., Wageningen, J., Meinderts, P., Bonnier, H., Kasper, Hatching Eggs by Hens or in an Incubator. Digigrafi Publisher, Veenendaal, Netherlands pp. 80 pp, 2004.
21. F., Wafadar, I., Puls, Improving Hatching and Brooding in Small-Scale Poultry. Agronomist Foundation and CTA, Wageningen, Netherlands pp. 80 pp, 2011.
22. M., F., Komolafe, A., A., Adegbola, L., A., Are, T., I., Ashaye, Agricultural Science for West African Schools and Colleges. 2nd Edition. University Press Limited, Ibadan, Nigeria pp. 289, 1981.
23. H., R., Wilson, Physiological Requirement of the Developing Embryo: Temperature and Turning. In: Avian Incubation S.G. Tullet, Butterworth-Heinemann, London, U.K. Chapter 9, and pp 145-156, 1991.
24. O., J., Adeosun, Further Work on the Development (Design and Construction) of a Low-Cost Incubator. An Unpublished B.Sc. Project. Department of Agricultural Engineering, Faculty of Technology, Obafemi Awolowo University, Ile-Ife, Nigeria pp. 66, 1997.
25. M. A. Baballe, "A Study of the Impact and Challenges Faced using Artificial Egg Incubation", Global Journal of Research in Engineering & Computer Sciences Volume 01| Issue 01 | Sep-Oct | 2021 Journal homepage: https://gjrpublication.com/journals/.