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# The Need for Artificial Egg Incubation

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**Abstract**— An egg incubator is a device simulating avian incubation by keeping the eggs warm at a particular temperature range and in the correct humidity with the help of a turning mechanism that assists to hatch the eggs. A well develops an improved egg incubator system that is capable of hatching an enormous number of chickens at a time and attaining high hatchability. The main heating elements may consist of sets of bulbs, which are used in providing the warmth needed in the incubator for hatching the eggs. Data from the sensors was processed by the microcontroller and the various control element were activated to help in moderating the condition in the incubator using machine language programming. An egg incubator with consistent, active, and proficient operation normally has the capabilities of providing sufficient poultry chicken which can oblige every household in the world nowadays with enough quantity of protein on daily basis.

**Keywords**—an egg, microcontroller, sensor, turning mechanism, and incubator.

## [1] INTRODUCTION

An Egg incubator is one of the most recent developments that provide jobs opportunity especially for those who want to be excellent farmers. The egg incubator system is designed to automatically control the humidity and temperature of the incubator for different types of eggs. The main purpose of this egg incubator is to take over the animal job to incubate an egg to hatching. Both bird and chicken eggs have been incubated with the help of an artificial method for thousands of years ago. Both, the Egyptians and Chinese are credited with originating artificial incubation procedures. Our world population is now growing at an alarming rate and so is the demand for protein. Poultry is a good source of protein and it is affordable at a cheaper rate. A broody chicken (a chicken that wants to set and hatch eggs and raise the chickens) can normally hatch just about 10–12 eggs at once in three weeks, which decreases its production as it normally takes time to incubate and hatch the chickens [1]. Benjamin and Oye [2] noted that some large birds, such as albatross and condors, usually lay only on a single egg every two years. Due to the world growing population, depending on this type of natural incubation is not good enough, henceforward they are a need for artificial incubation [3]. The most animated factor of incubation is the constant temperature required for an egg embryo to develop over a specific period. The humidity is also critical; when the air surrounding the egg in incubation is too dry, the egg will likely lose too much water to the atmosphere, which can make the hatching process difficult or impossible.

## [2] RELATED WORKS

Oluyemi and Roberts [4] recommended that the minimum and maximum temperature for the first eighteen days should be between 37.7°C and 39.3°C respectively. After the eighteen days of the incubation, the temperature should be reduced from 37.8°C to 36.0°C until the chickens were hatched.

Henceforth, for the whole period of incubation, the temperature should be maintained within the range of 36°C and 39°C which is following the report by other researchers [4,5,6,7,8,9,10,11,12,13,14]. However, Lourens et al. [15]; King'ori [16]; Geneve [17] acknowledged that overheating of the egg is much more critical than under heating, it will assist in speeding up the rate of growth causing abnormal embryos growth in the initial stages, and lower the percentage of the hatchability. Running the incubator at 41°C for 15 minutes will seriously affect the embryos [18] while running it at 35°C for 3 to 4 hours will only slow the chicken's metabolic rate [17,19]. A rise in temperature above 40.5 °C is fatal [20]. A drop in temperature will delay the hatching but is less harmful than increasing the temperature [20, 21]. The production of the chickens from an emergent embryo is a very sensitive task, which usually needs appropriate monitoring. Komolafe et al. [22]. Oluyemi and Roberts [4] suggested that the minimum and maximum humidity values within eighteen days should be 52% and 62% respectively. After the first eighteen days, the relative humidity should be improved from 55% to 71% until the end of the period of the incubation process. Henceforth, for the whole period of the incubation, the relative humidity should vary between 52% and 71%. Wilson [23] stated that it is best to turn the eggs more than three times a day for manual turning; they should be turned at an odd number of times so that the eggs will not be in the same position every night because that is the longest period between turns. More so, candling is very helpful during the incubation process, as it aids to determine whether the embryo is developing. The usual time for testing is the 7th and 14th days of incubation, sometimes the testing is done merely once on the 10th day. The eggs must not be candled after the 18th day to avoid disquieting the unhatched chickens because they need to rest and should not be handled during the last few days [24].

## [3] ADVANTAGES OF ARTIFICIAL EGG INCUBATION

Below are some of the impacts of using artificial incubation.

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.



#### [4] DISADVANTAGES OF ARTIFICIAL EGG INCUBATION

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 eggs breaking especially during egg turning.

#### [5] COMPONENTS USED IN THE ARTIFICIAL EGG INCUBATION

1. Container: Depending on how many eggs you want to hatch at a time, you may want something small that will hold just 20-30 eggs or a larger, cabinet style unit that will hold several hundred. Determine how many eggs you want to incubate and then decide on the container. The more insulation it has, the less energy it will require to keep it at the correct temperature. You don't want something that will be drafty, but you do need some way for fresh air to come into the container. The developing embryos need oxygen just like you and I do. The shell is porous and allows carbon dioxide to leave and oxygen to enter. A viewing window is handy for observing the eggs, especially while they hatch.
2. Heater: The size of the container, the amount of insulation it has, and the room temperature will all have an impact on how much energy, measured in Watts, you need for your incubator. Some of the popular table-top incubators (such as Little Giant and Hova-Bator) use a low wattage heating element. The Little Giant uses a 40 watt heater and the Hova-Bator uses a 25 watt heater. The larger Sportsman 1502 cabinet incubator uses a 225 watt heater.
3. Thermostat: Keeping a good temperature is so important for a good hatch. Developing embryos are quite particular about the temperature they need. A good thermostat will help you keep the temperature in the appropriate temperature range. The generally accepted ideal temperature is 99.5 degrees F (37.5 degrees C) for almost all birds. However, there are some exceptions. Emu eggs, for example, require a temperature between 96.5 - 97.5 degrees F.
4. Humidity control: Managing humidity in your incubator is a matter of keeping the appropriate amount of water surface area. As a general rule, the more water surface area, the higher the humidity will be in your incubator. You can use a container to hold water and refill it as needed. Many people find that putting a sponge in the water with part of the sponge above the water level will increase the humidity level. This is particularly helpful during the lock-down period the last 2-3 days of your

hatch.

5. Thermometer and hygrometer: A thermometer will measure the temperature and allow you to adjust the thermostat accordingly. A hygrometer will measure the relative humidity. There are analog devices and digital types as well. All measurement devices will have some variability, so testing and calibrating your device is always a good idea.
6. Egg Turner: The egg turner will rotate the eggs gently back and forth to keep the yolk sack from sticking to the shell and providing needed exercise for the developing embryo. This can also be done by hand if you prefer not to spend money on an automatic egg turner.
7. Candler: An egg Candler is a modified light that allows you to make the egg glow enough to see if the egg is developing. With a good Candler, you can see the baby bird moving and how the air sack is developing. If the egg is not developing, you can remove it to make room for good eggs.

#### [6] CONCLUSION

In this paper, we have seen the various advancement in technology of the artificial egg incubator, its challenges, its components use and the impact of deploying it over the natural hatching.

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