IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 5, May 2022
Impact Factor: 6.252

Semi-Automatic Egg Incubator

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Abstract: *The goal of this project is to create a design that is both functional and attractive an egg incubation system that can accommodate a variety of egg kinds. The technology will include humidity and temperature sensors that will monitor the incubator's settings and automatically adjust to the best circumstances for the job. The temperature or humidity is either too high or too low due to poor regulation. An electrical light is utilised as a heater in this project to keep the egg at a comfortable temperature. The humidity level can be changed by using water and adjusting the blower.*

Keywords: Incubator, Eggs, Humidity, Temperature, etc.

I. Introduction

The research involved in constructing an egg incubator for hatching bird eggs is examined in the following study. The incubator will assist the farmer in producing a high quantity of eggs in a short length of time. An egg incubator can be used to replace an animal's incubation phase. Furthermore, an egg incubator would not only greatly boost poultry production, but it will also provide a consistent source of income, allowing subsistence farmers to convert into prospective rural entrepreneurship. The batch's quality is determined by the temperature of the incubation. Low and high temperatures both reduce hatchability and result in weak chicks, thus regulating the incubation temperature at a comfortable level is essential. Artificial incubation of their own chicks is a common desire among poultry farmers. In order to produce healthy, active chicks, this sort of Endeavor requires careful care and incubation of the hatching eggs. Frequently, a producer may pay meticulous attention to the incubation process but overlook the care of the eggs before to their placement in the incubator. The embryo is developing and requires specific treatment even before incubation begins. Hatching eggs have a reduced likelihood of hatching if they are not properly cared for. The state of the incubator is a crucial consideration. The most common reason of poor performance is a lack of temperature and/or humidity regulation. When the temperature or humidity is too high or too low for a lengthy period of time, it interferes with the embryo's natural development and growth. Poor outcomes can be caused by insufficient ventilation, egg turning, and machine or egg sanitation. Temperature, humidity, and ventilation are the components that must be controlled in the incubator. The temperature must be adjusted according to the type of egg. In order to hatch a high proportion of viable eggs, an incubator must be able to maintain a constant temperature. Though different types of eggs require different temperatures to develop and hatch, the majority will do so at temperatures between 99- and 101-degrees Fahrenheit. To maintain humidity, the exposed water surface area is increased. Proper ventilation is essential throughout the incubation stage. In our project, we will design and construct a semi-automatic egg incubator to assist farmers in hatching eggs. Farmers will save time by using the egg incubator, which will boost their production and thus their income.

II. Literature Review

The literature review was the initial step in our design process. It entailed browsing the Internet for material for our project, interviewing people, and reading papers. We then specified the procedures and tests that would be utilized to perform the project based on the information gathered. We looked into a number of potential ways to carry out the assignment. The following alternatives were discovered: -

2.1 Still Air Incubators

A still air incubator is the most basic form of incubator. An insulated box with the following components makes up a still air incubator: - a source of heat, A thermostat or temperature controller. An egg tray and a thermometer to measure the temperature of the air. Some machines may feature a hygrometer that measures humidity. Some machines may have a

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rotating mechanism that automatically turns eggs. Convection, the air within a still air incubator is circulated. The air within the incubator expands and rises to the top as it heats up. The ratio of air temperature inside the box to outside determines the quantity of airflow achieved in still air mechanism. The stronger the air flow inside the box, the lower is the air temperature outside the box. Air inlets are frequently placed in the base and top of the incubator to provide proper air circulation. Warm air rises to the top of a still air incubator, causing various temperature to be measured at different levels. As a result, it is critical to keep a still air incubator on a level surface and ensure that all the eggs are of the same size.

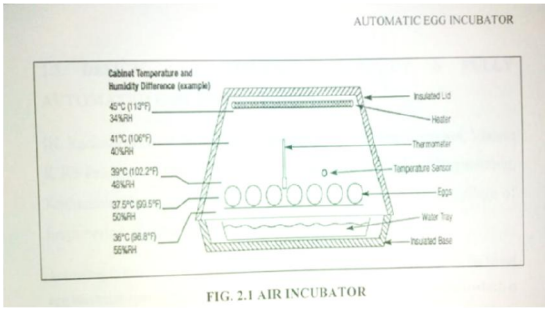

FIG. 2.1 AIR INCUBATOR

2.2 Forced Draft Incubator

Humidity in a forced air machine to keep the eggs from drying out owing to higher air flow rates. In order to tackle the problem of temperature gradients in the incubator, a machine was built. In a forced-draught incubator, a fan circulates the air to maintain a constant temperature throughout the unit. As a consequence, the ambient temperature around the egg remains stable, making the thermometer and temperature sensor's location less critical. Eggs come in a range of sizes and are placed in trays at different levels as well. You may use a Wet Bulb Thermometer to acquire an accurate reading on humidity while utilizing a forced-draught incubator. Control takes precedence above everything else.

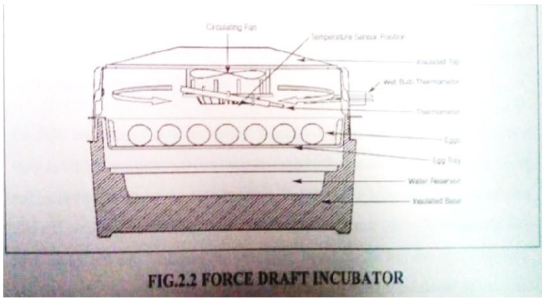
FIG.2.2 FORCE DRAFT INCUBATOR

2.3 Design and Implementation of Fully Automated Egg Incubator

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The goal of this project is to discuss the design of an egg incubator system based on an ATmega16 microcontroller that can maintain an ideal environment for embryo growth automatically. The system includes a temperature sensor that can monitor the temperature both inside and outside the incubator and sends the information to a microcontroller. The microcontroller uses relays to operate an incandescent light source and a air fan that circulates keep the egg temperature between 37 and 38.5 degrees Celsius. Furthermore, the temperature inside and outside the incubator is displayed on an LCD monitor. A user-programmable timer on the microcontroller controls a gear motor that tilts the egg hold [1].

2.4 Avicultural Reseach Institute-Mark Hagen

In artificial incubation of bird eggs, the best results are obtained by carefully collecting and preparing clean eggs, as well as by a contemporary, automated spinning, forced air circulated incubator with consistent solid-state temperature controls

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There are a few a slew of small-scale innovation incubator concepts on the market right now. Some with more Complex characteristics are more expensive, but the birth of a few more desirable parrot offspring can make up for the difference.

Incubation in a lab may be both an art and a science, which can be challenging. Losses and achievements, on the other hand, give experience and knowledge about each specific set-up, allowing remedial steps to be adopted. Regrettably, some breeders use a trial-and-error strategy, waiting to see if their eggs would hatch in the conditions they've created and/or only making modifications based on how the eggs that have died. It may be established if humidity changes are required before the egg is lost by measuring the rate of egg weight loss and comparing it to permitted criteria.

In forced air incubators, the optimal incubation temperature for antiracial bird the temperature of the eggs looks to be between 36.9-37.3°C (98.5-99.5°F). For most antiracial species, the mean total weight loss in fractions (the proportion of the initial egg weight lost) fin is in the range of 12 to 16 percent, with freshly deposited to pip loss in the range of 10 to 14 percent. Individual species may have optimal fins at both ends of these scales. It indicates that the degree of relative humidity required in the incubator to ensure maximal hatchability in some species is higher than previously thought. To evaluate incubator relative humidity, egg weight loss, and hatchability, further controlled scientific investigations are needed.

After the eggs have piped, they should be transferred to hatchers, which have a greater humidity and a little lower temperature than the incubator. It takes around two days for the eggs to hatch, after which the difficult process of nursing a blind, helpless antiracial chick may begin. [2].

2.5 Indian Journal Streams Research

[B.N. Kale Assistant Professor, Mechanical Engineering Department. Dr. Babasaheb Ambedkar College of Engineering and Research Nagpur, India.]

Incubation of poultry eggs is quite crucial these days, according to this research study, because the demand for chicken is growing every day. The traditional method of hatching eggs, on the other hand, is both complex and energy-intensive. In brief, the traditional technique of egg hatching needs a constant source of electricity. The design of a solar poultry incubator is proposed in this research, which might be used to hatch solar PV eggs and to minimize power consumption while maximizing the use of solar power, which is a sustainable source of energy. Bird incubators allow for a huge number of birds to be produced. The cost of this production has recently gotten out of control as a result of the global energy crisis. As a result, the cost of chicken production rises, making it expensive for the average person. It is vital to look at various means of generating energy for egg incubation in order to overcome this difficulty and even urge the rural farmer to go into bird production, which will provide a protein supplement for him and his family. We'll be in a position to do it lower the incubator's power consumption by 75% and the design cost by the same amount by using this way of solar poultry incubator. (3)

2.6 An Automatic Incubator Energy Research Journal

[Sirius Sansomboonsuk, Chagorn Phonhan and Girati Phonhan Faculty of Engineering. Mahasarakham University, Mahasarakham, 44150, Thailand]

The design of an automated incubator is divided into three elements. A mathematical model of an incubator is presented in the first section. To examine heat transmission characteristics, thermo-physical properties of chosen materials were replaced. The equipment needed to measure and control temperature and humidity is discussed in the second half. The final step is to choose an angled egg tray controller. The incubator in this investigation was intended to incubate 30 eggs at a time. The incubation cabinet measured 0.47X0.48X0.41 m in size.

A temperature of 37°C and a relative humidity of 80% RH were established in the incubator cabinet. Zinc sheet is used on the inside, while acrylic plastic sheet is used on the outside. Plywood was used as insulation. As a heat source, four 60-watt halogen lights were used. Two small fans were put within the cabinet for air circulation. An AP 104 board received thermocouple type K input signals and linked them to a relay. This board is used to monitor and manage temperature and humidity levels. A limit switch was utilized to control the angle of the slanted egg tray. The results of testing the measurement and control system without an egg showed that the system provided good accuracy. The average chick biddy hatched 81.665 percent of the hatching eggs incubation studies.

The effect of rotating frequency on the hatchability of chicken eggs in a hurricane lantern incubator. In a hurricane lantern incubator, it should be manually spun three times a day for low egg weight loss and increased chick hatchability. Consistent

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egg flipping will aid in the positioning of developing embryos and ensure that nutrients are supplied uniformly for embryonic development. Farmers' living standards might be improved by using such an incubator for small-scale hatchery operations. (4)

2.7 Characterization of a Photovoltaic Powered Poultry Egg Incubator

[W. I. Okonkwo 1 0, and O. C. Chiweenie 2 1 Okonkwo W. I, National Centre for Energy Research and Development, University of Nigeria, Nsukka, 2 Chiweenie O. C, Agricultural and Bio resources Engineering, University of Nigeria, Nsukka]

Incubation of chicken eggs is critical in the whole poultry production system, particularly when day-old chicks are growing Chicken farming is a lucrative business industry. However, in Nigeria, absence Privately held hatchery machinery restricts growth and raises the cost of chicken products such as day-old chicks, notably in the country's south-eastern area. In Nigeria, there are now just a few commercially owned chicken hatcheries in the west and the north sections of the nation. Although the majority of these hatcheries have limited or no connectivity to the national grid, they function at roughly 60% of their installed capacity. Pollution of the environment, in general, and unreliability.

The chicken hatchery sector in Nigeria, which is fueled by traditional energy, is in poor shape due to a lack of grid power and low performance efficiency. This obstructs and impedes the building in the country's rural areas of medium to large-scale chicken production facilities Nigerian poultry producers, on the other hand, would be able to incubate and hatch chicken eggs as well as breed day-old chicks in a clean environment if solar energy-powered equipment were used in poultry production. This study examines the characteristics of a photovoltaic (PV) powered chicken egg incubator. An egg incubation chamber, a power supply unit, and an energy storage unit make up the system's three primary components. The incubator can handle up to 375 eggs in a single batch of incubation. The incubator's physical performance examination revealed range of temperature and relative humidity should be 36 to 39 C and 77 to 67 percent, respectively, while a biological test utilizing fertilized poultry eggs revealed a 74 percent efficiency.

The successful invention and characterization of a solar-powered chicken egg incubator contributed significantly to the Nigerian poultry industry's innovation. As long as solar radiation is accessible, a solar PV powered incubator may be used everywhere. This research proposes a solution to a key power insufficiency limitation for commercial chicken egg incubation in Nigeria.

III. Simulation Work (Analytical)

The following are the processes to hatching eggs, according to the information we found:

The location has an impact on regulation, it's critical to locate the incubator in an area with low temperature change. The temperature should be between 99- and 102-degrees Fahrenheit (C0 and F) (37.2 C0 and 38.8 C0).

Before putting the eggs in the incubator, turn it on for at least 24 hours. Obtain the eggs.

- Purchase all of your eggs from a single source. By ordering from a single source, you can ensure that your eggs are of similar age and kind.
- Allow at least 24 hours for the eggs to settle before placing them in the incubator. As the eggs settle, point the little ends down.
- In the incubator, place the chicken eggs. Place the eggs on their sides on a plate.
- During the first 18 days, turn the eggs 2 or 3 times each day. After 18 days have passed, do not flip the eggs.
- Every time you turn the eggs, check the temperature in the incubator.
- In an incubator without a fan, keep the temperature as near to 101.5 degrees F (38.6 degrees C0) as feasible. At the top of the eggs, take the temperature of the air.
- In an incubator with a fan, aim for temperatures around 99.5 degrees F (37.5 degrees C0); this temperature reading can be taken anywhere within the incubator.
- Even if you aren't rotating the eggs, keep an eye on the temperature throughout the last three days of incubation.
- Use a hygrometer to monitor the humidity level in your incubator.
- During the first 18 days, keep your eggs in an atmosphere with a humidity of 60 to 65 percent.
- Increase the humidity to 80 to 85 percent for the last three days (days 18 to 21).

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- Increase the humidity level in the incubator by adding wet surface area. Add a large pot of water or wet sponges to the mix.
- Reduce the humidity level by removing damp surface area. Remove wet sponges from a large pan of water and replace it with a smaller dish.
- Between the 18th and 21st days, don't open the incubator door. The temperature and humidity levels of the incubator are severely affected when the door is opened, which has a detrimental influence on the incubated eggs.

Incubating the Eggs:

- Bring the viable eggs to room temperature before using. After you've introduced the eggs to the incubator, allowing the eggs to warm up will reduce the quantity and length of temperature fluctuations in the incubator.
- Draw a symbol on each side of the eggs. To signify either side of the egg, many people use the letters X and O.
- On one side of the egg, softly draw a sign of your choice, and on the other side, lightly draw a second symbol.
- Carefully place the eggs in the incubator. Ensure that the eggs are on their sides. Each egg's bigger end should be somewhat higher than its pointy end. This is crucial because if the pointed end is higher, the embryos may get misaligned and may not develop properly.
- Allow for a reduction in temperature after adding the eggs. After you've placed the eggs in the incubator, the temperature will drop briefly, but it should return to normal if we calibrated the incubator correctly.
- Do not raise the temperature to compensate for the temperature change; otherwise, our embryos may be damaged or killed.
- Keep track of the day and the number of eggs you've put in the incubator. Based on average incubation times for the bird species you intend to hatch, we should be able to predict your hatch date. Chicken eggs, for example, take 21 days to hatch on average, whereas duck and peafowl eggs might take up to 28 days.
- Make sure to turn the eggs every day. The impact of any temperature fluctuations within the incubator can be mitigated by rotating the eggs and altering their location.
- Every day, turn the eggs an odd number of times. This manner, the sign on the eggs changes every day after you turn them, making it easy to determine if you've turned the eggs for the day.
- Rotate the eggs in the incubator to different places.
- During the last three days of incubation, stop turning the eggs since they will hatch shortly and turning is no longer essential.
- Adjust the incubator's humidity settings. During incubation, humidity should be kept between 50 and 55 percent, until for the last three days, when it should be raised to 65 percent. Depending on the sort of eggs you want, we may need higher or lower humidity levels.
- Regularly replenish the water in the water pan to keep the humidity levels from dropping too low. Warm water should always be added.
- If you need to enhance the humidity, place a sponge in the water pan.
- Using a wet bulb thermometer, check the humidity level in the incubator. Take a temperature reading with the wet bulb thermometer and note the temperature in the incubator at the same time. To find the relative humidity from the connection between the wet bulb and dry bulb temperature data, use a chart or psychometric chart online or in a book.

IV. EXPERIMENTAL VALIDATION

4.1 BOX

Box is made up of MDS (Medium Density OF The h will s ammonium angle used to hold and slugs the cutting the Fig is the rectangular cross-section of boss on s one vides small pat pill he pies easy entering the water tray So in inner side s will he prints f hoping using tray and mat Sensor is mounted at one of its sides.

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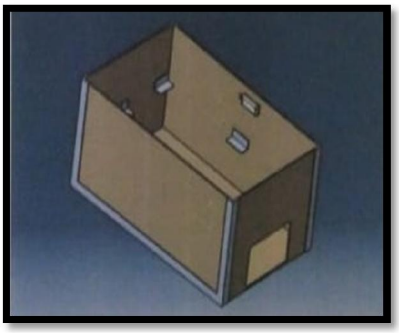
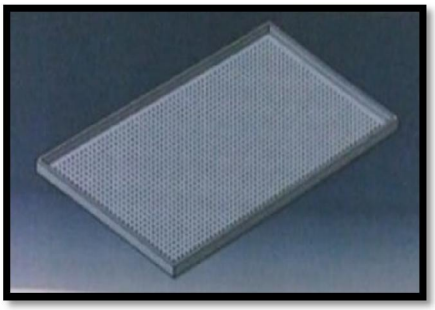


BOX

4.2 MAT

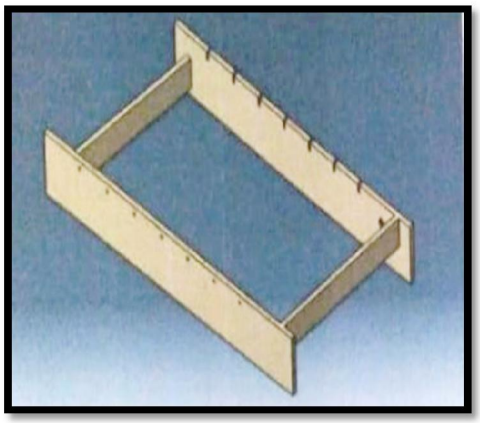
It is made up of polymer formed as a net in the incubator is used after 18 days, we will put all hatch able eggs on mattress Candling is done on eggs before laying on the mattress. The dimension of MAT is such way that it will be easily removable for the box. It gives the free space to move on the MAT after successful hatching of egg.



MAT

4.3 Tray Holder

The egg turner gently rotates the eggs back and forth to protect the yolk from adhering to the shell and provide vital exercise for the growing embryo. If you don't want to spend the money on an automatic egg turner, you may do it by hand. It has a slot and proper strength to sustain the weight of eggs with its tray. It is made up of MDF having thickness more than the link we are using. Motor is fitted at the corner position.



TRAY HOLDER

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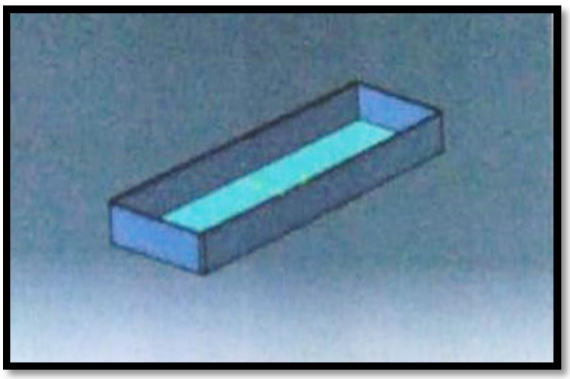
4.4 Water Tray

It is the plastic tray we use to store water. We are using water to control the humidity. So, we have to required sufficient water to control the humidity throughout the experiment... Adding water regularly to the water tray during the 21-day incubation period keeps the humidity at a proper level. It is the most important parameter in the incubation. Variation in the humidity may lead to the unhealthy growth of embryo.



WATER TRAY

V. CALCULATION

The capacity of the incubator will be of 65 eggs.
By our personal research we found that a dimension of Single Egg will be approximately equal to 4.2cm.
Hence, we decide to make a tray of 273cm.
Therefore, the size of the incubator will be 57*36*28 cm.
A 60–75-watt bulb will be required to generate the required amount of heat with proper ventilation.

VI. FUTURE SCOPE

Design a system and hardware for an egg incubator that uses a programmable interface controller (PIC) to automatically manage temperature and humidity based on the kind of egg and parameters provided by the user. In addition, solar energy may be used to power the incubator. Regardless of the environment, a large number of eggs can hatch at once. Taking the project to a commercial level of scale.

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Impact Factor: 6.252

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