CONSTRUCTION OF AN EGG INCUBATOR

BY:

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ND/23/ABE/FT/0022

BEING A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL AND BIO-ENVIRONMENTAL ENGINEERING TECHNOLOGY, INSTITUTE OF TECHNOLOGY, KWARA STATE POLYTECHNIC, ILORIN.

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF NATIONAL DIPLOMA (ND) IN AGRICULTURAL AND BIO-ENVIRONMENTAL ENGINEERING TECHNOLOGY

2024/2025 SESSION

DECLARATION

I hereby declare that this project titled "Construction of an Egg Incubator" is my original work carried out under the supervision of (Engr. Mrs Onipede E.A)

I also declare that to the best of my knowledge, all sources of information used in the course of this work have been duly acknowledged.

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CERTIFICATION

I, hereby declare that this research project titled **CONSTRUCTION OF AN EGG INCUBATOR** was carried out by Oyedokun Goodluck with matric number ND/23/ABE/FT/0022 is my own work and has not been submitted by any other person for any degree or diploma in any higher institution. I also declare that the information provided therein are mine and those that are not mine are properly acknowledged.

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DEDICATION

I dedicate this project to the Almighty God for His guidance and strength throughout the course of this work. I also dedicate it to my beloved parents, mentors, and friends whose support and encouragement have been a great source of inspiration to me.

ACKNOWLEDGEMENT

I would like to thank God Almighty for the strength, wisdom, and grace given to me to successfully carry out this project also, I sincerely appreciate the guidance and support of my supervisor, (Engr. Mrs Onipede E.A) whose constructive criticism, encouragement, and valuable suggestions helped shape this work.

Also, My gratitude also goes to the lecturers and staff of the Department of Agricultural and Bio-Environmental Engineering for their continuous support throughout this academic journey.

I would not end this acknowledgement without appreciating my family for their moral and financial support, especially during the construction and testing phases of this project.

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ABSTRACT

An egg incubator was constructed using locally available material for affordability to increase the production of chicks and improve the income of poultry farmers. The Incubator was constructed from medium density fibreboard plywood for it's consistency, workability and affordability. To conserve the heat, the Incubating box was lagged with fiberglass. The Incubating box consist of eggs trays, water tray, bulbs, thermostat, hygrometer, fan for optimal Incubating condition. The constructed egg incubator was tested for functionality and effectiveness and the result showed that the range of Incubating temperature and humidity were maintained which indicate the Incubator is suitable for poultry eggs incubator

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Agriculture is the science, arts, and practice of cultivating the soil, growing crops, and raising animals for food, fiber and other Products Used to sustain human life it is one of many economics, especially In developing Countries.

Agriculture Includes crop production, animal husbandry, forestry, and fisheries.

Poultry farming plays a vital roles, in global food production and rural development one of the major challenges faced by poultry farmers is the Ineffective and inconsistent Incubatian of eggs which determine the hatch rate and overall productivity. Traditional method of Incubation using broody hens are Unreliable and limited In capacity while imported electric Incubators, effective but at an excorbitant price.

To address this issue there is a need for an egg Incubator using local available material

1.2 Statement of Problem

The natural Incubation can only hatch between 10 - 15 eggs at a time, hence there is a need for artificial Incubator that can hatch a large number of eggs at a time and constructed from locally available materials for affordability by poultry farmers.

1.3 Aim and Objective

The aim of this project is to construct an egg Incubator that can be affordable by poultry farmers to increase the production level while the specific objective is to construct an egg incubator using locally available materials. (MDF plywood) I.e medium density fibreboard plywood

1.4 Justification

This project work will improved chick health, increased hatchability, cost effective and boost production level of poultry farmers year round there by improve their livelihood.

1.5 Scope of Study

The scope of this study is limited to construction of a functional egg incubator using locally available materials

CHAPTER TWO

LITERATURE REVIEW

2.1 Incubation Technology

Incubation is the process of keeping fertilized eggs under controlled environmental condition mainly temperature, humidity and ventilation until they hatch.

2.2 Types of Incubator

There are majorly two types of incubation; natural and artificial

2.2.1 Natural Incubation

Is the process by which a mother hen (broody hen) sit on her eggs to provide the necessary warmth and condition for hatching. The method involves low cost and does not require the use of any machine. However it is limited to small scale production, depends on the hens willingness to sit and has risk of disease or predators.

2.2.2 Artificial Incubation

The method of incubation uses machine called incubator to simulate the condition needed for embryo development it allow for large scale egg hatching offers controlled a consistent conditions and improve hatch rate. However it requires electricity or fuel for the source of energy, has a high initial cost and need technical knowledge for proper operation.

There are various types of artificial incubator, kerosene incubator, electricity incubator, bio -gas incubator, charcoal incubator, solar incubator and hybrid incubator.

(a) Kerosene incubator is the type of incubator powered by kerosene

(b) Electricity incubator is the type of incubator powered by electricity

(c) Charcoal incubator is the type of incubator powered by charcoal

(d) Bio-gas incubator is the type of incubator powered by bio-gas

(e) Solar incubator is the type of incubator powered by Solar

(f) Hybrid incubator is the type of incubator that combine two sources of energy to achieve incubation process.

2.3 Classification of Incubator

Incubator can be classified into still air and forced air incubator

(i) Still air Incubator: Rely on natural convection to circulate air and maintain temperature and humidity levels, temperature and humidity levels are not uniform within the incubator, employ by small scale poultry farmers, have simple design and cost effective.

(i) Forced air Incubator: This type of incubator uses fans to circulate air and maintain uniform temperature and humidity level within the incubator that can improve the hatchability, the design is more complex, expensive and employ by medium and large scale poultry farmers.

2.4 Incubating Parameters

Incubator parameters are the specific conditions required for successful incubation of eggs these parameters include;

1.Temperature: Optimal temperature ranges between 99-100°f (37-38°c) for chickens eggs with slight variation for other poultry species

2.Humidity: Range between 50-60% relative humidity for the first 18 days increasing to 60-70% for the final 3 days

3.Egg turning: Egg should be turned 3-5 times per day, with the turning angle gradually increasing as incubation progress

4.Ventilation: Adequate ventilation is essential to maintain optimal oxygen and carbon dioxide levels within the incubator

5.Positioning of eggs: Eggs should be placed with the larger end (air cell) facing up, ensure proper air space development and chick positioning before hatching

2.5 Review on Artificial Incubator

Many researcher had worked on artificial incubator with various results and recommendation

Hassan et al. (2021) in characterizing an electric incubator recorded a hatchability percentage of 80.9% and concluded that the major challenge of incubators that work with electricity are the excessive billing rate, erratic power supply as well as the complete absence of electricity in remote regions. Equally, most of the incubators in developing countries like Nigeria operate at 60% below designed capacity due fluctuating grid-electric supply. Olaoye et al. (2013) developed a 120 egg capacity electric incubator. The system which was coupled with three 100 watts electric bulbs produced 75.2% fertility in addition to hatchability rate of 64.8%. Muhammad et al (2021) carried out a performance evaluation of a designed HEFINC840 Micro-controller based incubator. The system with a capacity of 840 chicken eggs produced a hatchability and fertility rates of 88.21% and 95.83% respectively.

Ogunwande et al (2015) studied a still-air hatchery that has a non-thermostatic control. The system uses electric bulbs as the heat source with a resistance-varying component as temperature control. With three times daily of the eggs, the system achieved 62% hatchability rate. Harb et al. (2010) studied a 60 capacity poultry egg incubator for small farmers in Egypt. The authors recorded a hatchability rate of 82.6%. Soeb et al (2021) developed a low-cost incubator that is made up of an embedded controller incorporated to an egg turning trays with a hatchery apartment of 116 egg capacity for Bangladesh market. The manual and automatic evaluations of the developed hatchery showed a 79.3% and 87.1% hatchability rate respectively. The eggs were turned both manually and automatically as the case may be at intervals of 6 hours.

Mansaray and Yansaneh (2015) developed a solar power egg incubator that achieved temperature range of 36.8-37.9°C. The evaluation of the system yielded a percentage fertility and hatchability of 43.3% and 23.1% respectively. The study concluded that the low level of hatchability was as result of several external influences such as an overcast weather, improper egg storage, time and energy loss in turning of eggs, faulty eggs etc.

Muhammad et al (2022) studied a thermoelectric egg incubator coupled to a heat storage system. The thermoelectric component is utilized in the daytime process while a heat storage system made up of phase change materials (PCM) which provides thermal energy during off-sunshine (especially nights) periods is the complimentary heat source. The electric energy that is changed to heat for starting the operation is

provided with the arrays of the solar PV. The result of the 300 egg capacity system showed that temperature inside incubation chamber was between 36-39°C with 73.3% hatchability.

CHAPTER THREE

MATERIALS AND METHODOLOGY

3.1 Materials

The materials used in the construction of an egg incubator are as follows;

1. MDF plywood (medium density fibreboard plywood)

2. Glass material

3. Hinge and latches

4. Eletric bulb

5. Thermostat

6. Dc fan

7. hygrometer and water tray

8. Egg tray

9. Screw/nails

10.Wires/switches

11.Foam

3.2 DESCRIPTION OF THE INCUBATOR

The egg incubator is constructed from MDF plywood because of it workability, consistency, affordability and conservation of heat the incubator is a rectangular box which consists of egg trays, bulbs, water tray, thermostat and hygrometer fan to maintain optimal condition for the hatchery of eggs. Figure 1 and 2 show the isometric and exploded view of the eggs incubator

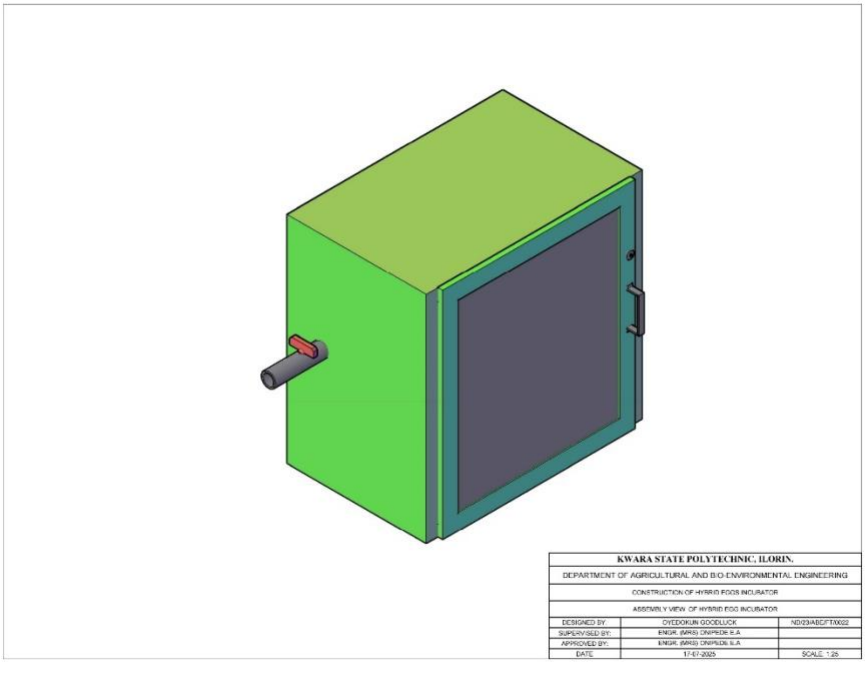


Figure 1: Isometric view of the egg incubator

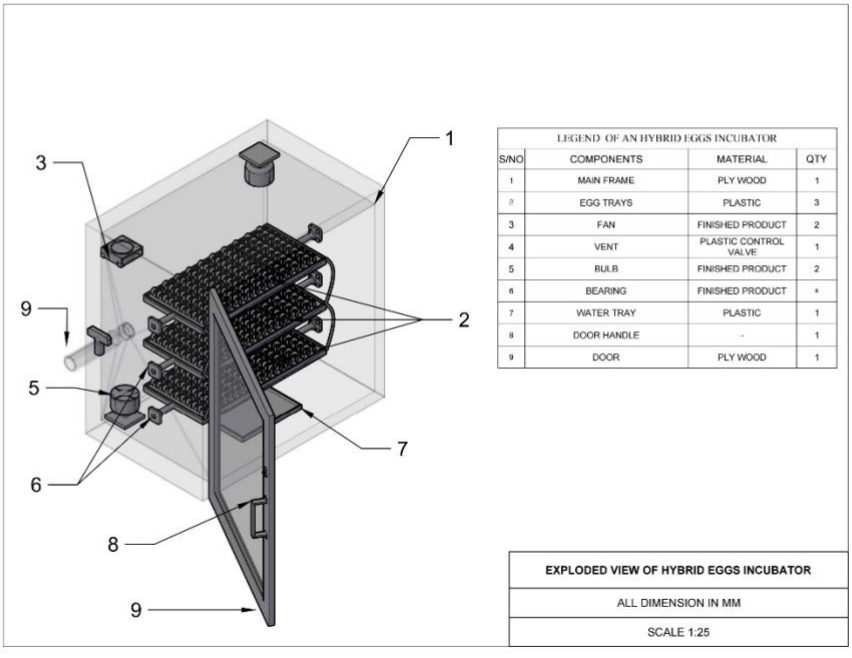


Figure 2: Exploded view of the egg incubator

3.3 Construction of Incubator

The tools used for the construction are; hammer, hacksaw, paper tape, sand paper, nail, bolt and nut.

The procedure for the construction of egg incubator are as follows;

(i) The MDF plywood was cut and assembled into rectangular box using nails, screw, hacksaw and hammer

(ii) The inside was lined with fibre glass for insulation

(iii) A fan was mounted at the back to circulate air

(iv) Bulbs were installed on the side for heating

(v) The thermostat was fixed and wired to regulate temperature

(vi) A hygrometer and water tray were added to control humidity

(vii) An egg tray was built and placed inside with space to allow turning

(viii) A glass window was installed on the front for observation

(xi) The hinge and latches is fixed for door opening

3.4 Operation of Incubator

The incubator mimic the condition provided by a brooding hen. The heat source raises the temperature the fan distributes the air and humidity is regulated with water trays. The thermostat ensures that temperature remain constant and eggs are turned regularly to prevent embryo sticking and promote uniform development the incubator is powered by electricity.

3.5 Factors Considered in Construction of an Egg Incubator

The following factors were considered in the construction of an egg incubator

1. Availability of material:-The material used is easily available for repair and replacement

2. Workability of material:-The material used is easy to cut, drill and shape

3. Affordability of material:- The material is cost effective compare to solid wood

4. Heat conserved of material:- The material has insulating properties that conserve heat.

3.6 Bill of Engineering Measurement and Evaluation [BEME]

The bill of engineering measurement and evaluation is as shown in table 3.1

Table 3.1: Bill of Engineering Measurement and Evaluation (BEME)

S/N	Item	Quantity	Unit Cost (₦ : K)	Total Cost (₦ : K)
1.	MDF plywood	1	35,000	35,000
2.	Glass marine bard	1	45,000	45,000
3.	Hinge and latches	2	1000	2,000
4.	Electric bulb	2	1,500	3,000
5.	Dc fan	2	8,000	16,000
6.	Thermostat	1	16,000	16,000
7.	Hygrometer	1	10,000	10,000
8.	Egg tray	6	8,00	4,800
9.	Screw/nails	1	3,000	3,000
10.	Water tray	1	1,500	1,500

11.	Wires & switches	1	4,000	4,000
12.	Fiber glass	1 roll	10,000	10,000
13.	Miscellaneous		15,000	15,000
	Total			**₦165,300**

3.7 Testing of Incubator

The incubator was tested for five days to see the functionality and effectiveness of the incubator without eggs. i.e, the temperature, humidity, fan and bulb.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 Result

The result showed that the incubator maintained the set temperature, humidity and the fan and bulbs were functioning.

4.2 Discussion

The choice of materials contributed to proper insulation and heat retention, while the thermostat eliminated the need for constant manual temperature checks. The cost of construction was relatively low compared to commercial incubators, making it a viable solution for poultry farmers.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The constructed egg incubator was efficient, reliable and affordable because it maintains ideal condition for artificial incubation; stable temperature adequate humidity and air circulation during the test runs of the incubator.

5.2 Recommendation

Provide basic training to users on how to operate and the incubator should be tested using different species of poultry egg for hatchability, fertility and mortality rate.

REFERENCES

Abba-Aji, M. A., Usman, A. R., & Shuwa, M. (2024). Smart Solar Hybrid Egg Incubator for Small Scale Farmers. *Arid Zone Journal of Engineering, Technology & Environment*; 132-egg capacity; solar-battery powered; 150 W consumption and robust thermal control.

Adewunmi, B. A. (2021). Preliminary studies on AC/DC heat source cum kerosene lantern for egg incubation. *Nigerian Journal of Animal Production*, 31(1), low hatchability (~18.8%) due to ventilation issues.

Aliyu, S. O., Ayanwale, B. A., & Agboola, A. K. (2013). Increasing Livestock Production in Nigeria, Cost-Effective Bird Egg Incubator Models. Covers charcoal-fired and forced-air incubator variants with temperature/humidity management.

Etoamaihe, U. J., & Paul, T. (2023). Development of a Charcoal-Heated Egg Incubator for Family Poultry Farming. Efficiency ~63%, includes performance evaluation and temperature regulation system.

Musa Adame, M. J., Yusuf, Y., & Kuda, N. T. (2023). Influences of incubator energy types on hatchability. *Advances in Applied Sciences*, energy-source comparison, kerosene risk factors.

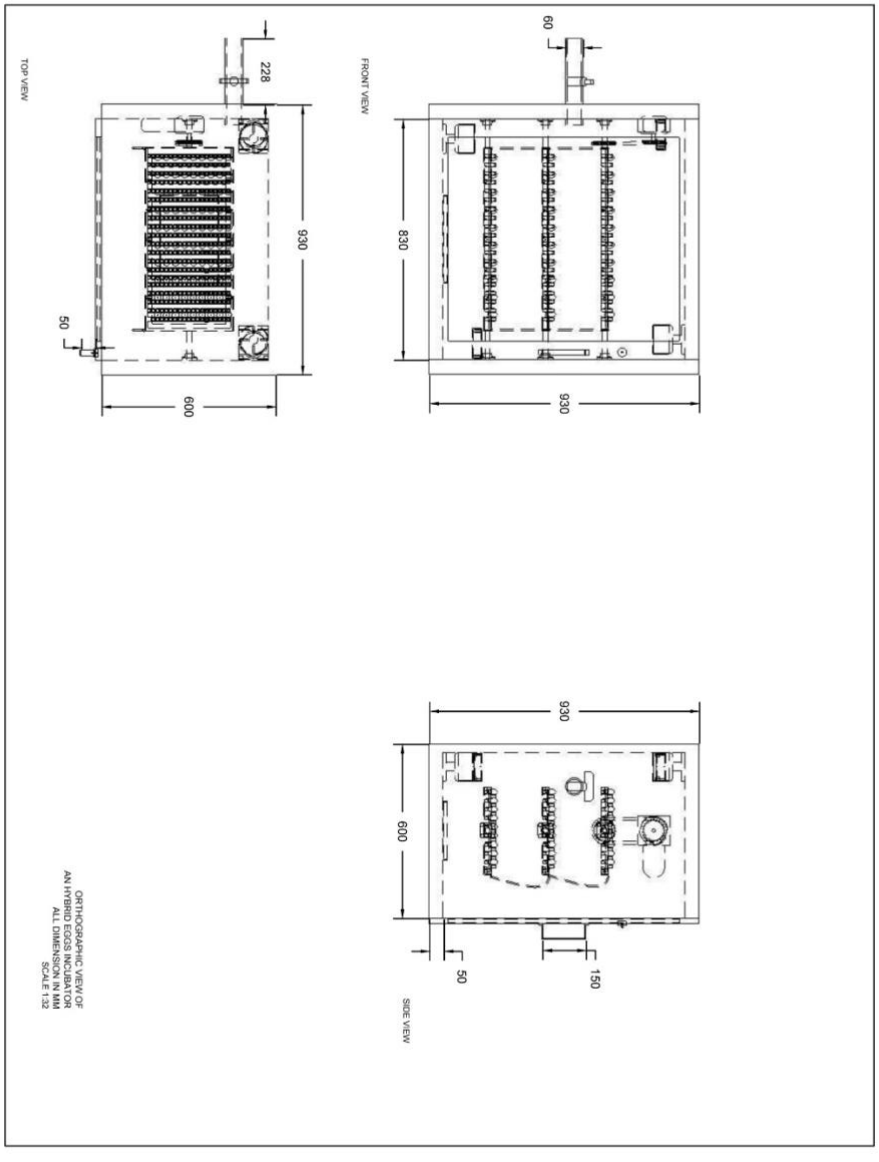
Ogunwale, G. A., Akinola, E. O., & Lana, A. R. (2015). Development of a Biogas-powered poultry egg incubator. *Ife Journal of Science*, Vol. 17, pp. 219–228.

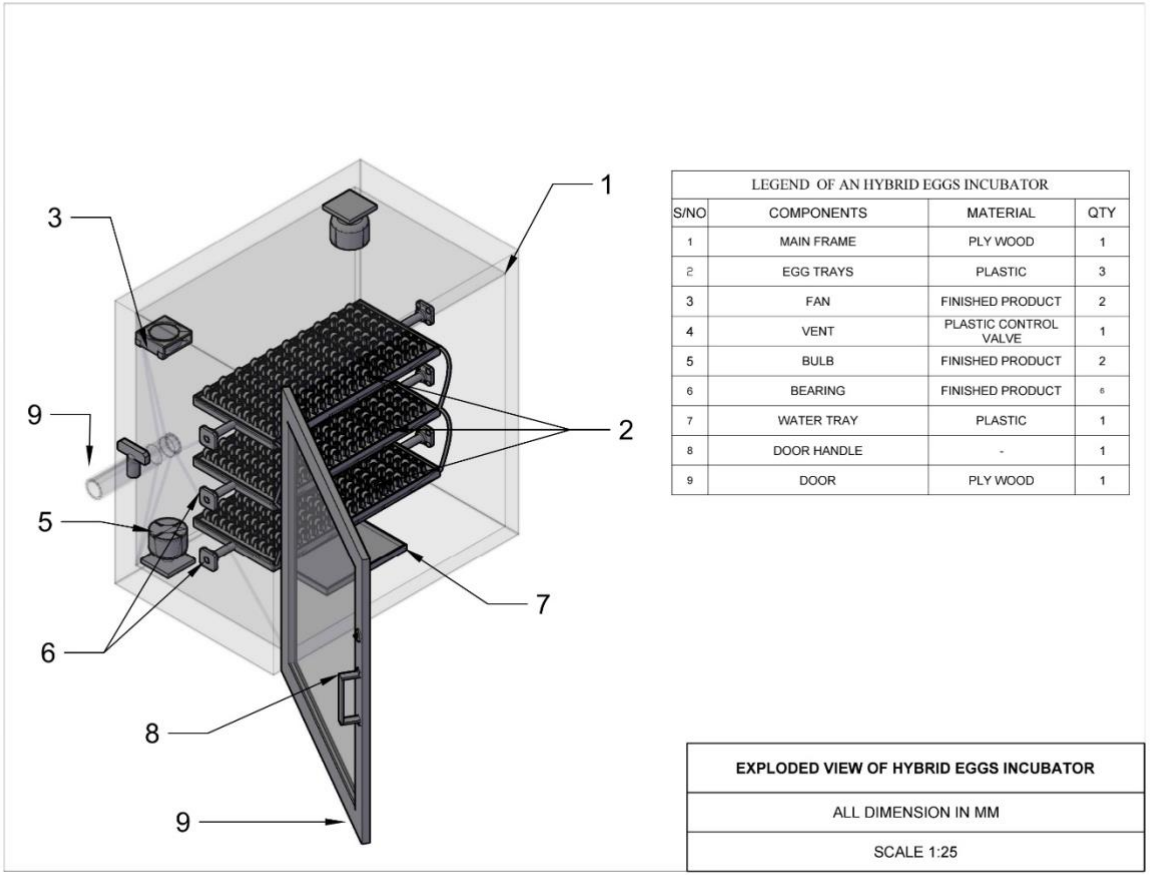
Okoye, I. O., Lawal, B. M., Ibrahim, S. O., & Sanni, B. A. (2013). An electrically operated incubator for household. *Greener Journal of Science and Technology Research*, Vol. 3 issue 5, pp. 160–165.

Osanyinpeju, K. L. et al. (2018). Performance Evaluation of a Solar Powered Poultry Egg Incubator. *International Research Journal of Advanced Engineering & Science*, maintained 36–39 °C and hatchability of 44%.

Sulley, P. Z., Maagi, M. T., Chande, Y. A., & Jande, B. K. (2023). Hybrid solar/LPG incubator with beeswax thermal energy storage. *Renewable Energy Systems* – achieved 70% hatch efficiency, with beeswax TES providing thermal regulation.

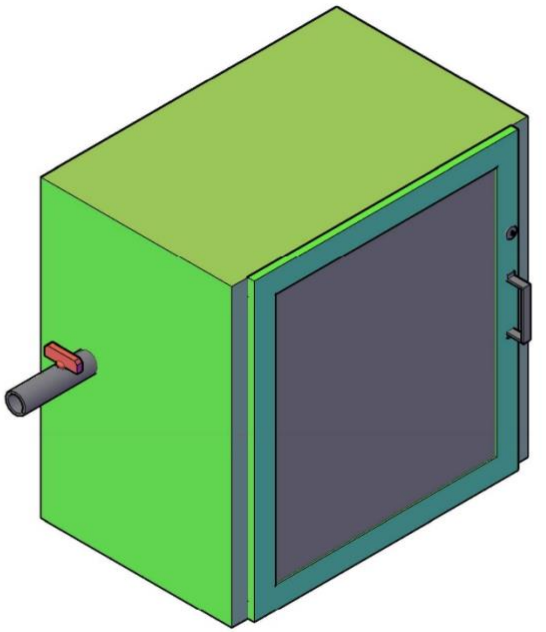
Tesfaye, D. M. (2021). Simulation and Experimental Evaluation of Solar Powered Egg Incubator with Integrated Thermal Energy Storage; Case Study, West Showa Zone, Ethiopia. *Journal of Energy Technologies & Policy*, 13(3), hatchability 27.27% at 36.5–39.5 °C.


TOP VIEW
228
930
50
600
FRONT VIEW
60
830
930
930
600
50
150
SIDE VIEW
ORTHOGRAPHIC VIEW OF
AN HYBRID EGGS INCUBATOR
ALL DIMENSION IN MM
SCALE 1:32



LEGEND OF AN HYBRID EGGS INCUBATOR			
S/NO	COMPONENTS	MATERIAL	QTY
1	MAIN FRAME	PLY WOOD	1
2	EGG TRAYS	PLASTIC	3
3	FAN	FINISHED PRODUCT	2
4	VENT	PLASTIC CONTROL VALVE	1
5	BULB	FINISHED PRODUCT	2
6	BEARING	FINISHED PRODUCT	6
7	WATER TRAY	PLASTIC	1
8	DOOR HANDLE	-	1
9	DOOR	PLY WOOD	1

EXPLODED VIEW OF HYBRID EGGS INCUBATOR
ALL DIMENSION IN MM
SCALE 1:25



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DEPARTMENT OF AGRICULTURAL AND BIO-ENVIRONMENTAL ENGINEERING		
CONSTRUCTION OF HYBRID EGGS INCUBATOR		
ASSEMBLY VIEW OF HYBRID EGG INCUBATOR		
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DATE	17-07-2025	SCALE: 1:25