Low Cost Incubator Create New Income for Rural Villages

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***Abstract*: Incubator is a part of electric device which is maintained temperature and humidity with preferences condition including 6th times manually turning of eggs per day until incubation period. Incubator like as broody hens body heat transfer to egg cell until hatching. An incubator was designed with the XH-W1209 Thermostat for regulating heating and cooling. Low cost incubator design archive the goal and solutions of low rate of broody hens hatching problems for rural areas and start-up the small poultry business to create good economical source which helped significantly at Indian rural communities. The designing of a low cost incubator consists of three main parts. First part is a problems low percentage of broody hens hatching success.Thermo-physical properties of selected materials its heat transfer[8] characteristics [1,9]. The second part is the consideration cost of equipment used to measure and control temperature and humidity The last part is manually rotating egg with time schedule. In this study the incubator was designed to incubate 100 eggs each time. The volume of incubator box was 14000 square centimeter. Thermostat maintains required temperature humidity controller was set with heater circuit for maintaining moisture of egg cell. Inside wall made from thermocol & outside wall Paper Cartoon box. Halogen bulb selected as a heat source. Inside cabinet, two small fans were installed for cooling and air ventilation. XH-W1309 utilized for measuring and control temperatures. From testing the measuring the system without egg, the results shown that measuring and control system perform high accuracy. Output Results of the incubation percentage is equally 70% with minimal error.**

Keywords: Low Cost Incubator; Rural Village; Create New Income; Increase Hatching Capacity.

1. INTRODUCTION

An incubator is a device which incubate eggs warm at a particular temperature range and in the correct humidity with a turning mechanism to hatch them. A modern egg incubator The common names of the incubator in other terms include breeding hatching machines or hatchers, setters [15,16]. The full incubation period for an egg, from laying to hatching, is 20 to 21 days. It depends on different types of bird. During this time, a hen sits on her egg(s) and maintains a temperature of 37°C to 38°C This temperature is needed to ensure proper embryonic development. There are two main types of incubator for hatching the eggs first one Natural incubation Second Artificial incubation [6].

Natural Incubator:-The broody hen chosen for natural incubation should be small with a good brooding And mothering record Signs of broodiness are that the hen stops laying, remains sitting on her eggs. The hen keeps the eggs at the correct humidity by splashing water on them from Her beak. This is a further reason for providing her with easy access to water. Eggs initially need a very controlled heat input to maintain the optimum Temperature of 37°C to 38°C because the embryo is microscopic in size [14].As the embryo Grows in size within 18 day it produces more heat than it requires And may even need cooling. Moisture levels of 60% to 80 percent Relative Humidity increasing during the incubation period [2] are important to stop excess Moisture loss from the egg contents through the porous egg shell and Membranes A hatchability of 80 percent (of eggs set) from natural incubation is normal, but a Range of 75 to 80 percent is considered satisfactory. But broody hen can be hatch 10 -15 eggs can be placed under one bird [7]. The ordinary hen will only cover 8-10 eggs. The broody hen sometimes leaves the hatching eggs before the eggs are hatched. Main disadvantage is breaking of eggs may occur due to faulty sitting of broody hen. This method is not suitable for hatching large number of eggs at a time. Sometime hen do not lay egg so long they are engaged in hatching of eggs. The total production of eggs may be hampered in case Artificial Incubator is preferably at anytime [11].

Artificial Incubator:-Modern incubators system working on controlling heating and cooling by a thermostat which is placed as a large insulated box or room which is creating hatching condition artificially by controllable systems. It's recovering the drawback of natural incubation process. Some industrial incubators are large enough to hold up to 2 –3 lakh [12] and some other styles can only hold a few eggs [10].

The styles of incubators include- 1-Setter incubator. 2-Hatcher incubator. 3-Combination incubator.

2. METHODOLOGY

Mechanical Design- it is very important part of Incubator system, material choice is difficult while considering the cost of incubator casing. Different types of casing use by top manufacturers but after analyzing the data we have to decide if we can insulate the system with low cost materials it should be helpful for all user. At Indian Average annual temperature is warm as 25.78°C but hatching temperature around 37°C in this case we can considering the insulation because heating balance is not difficult while difficult to cooling the system that the reason for choosing Thermocol (scientific name Polystyrene) is used for insulted the box, and for mechanical support we have choose a cardboard box which is available in local market at sufficient cost.

Hardware Design-Hardware component are simple and it's easily Available in Indian local market or online store with low price. Two main components are XH-W1209

Thermostat for controlling the temperature accurately; for heating source incandescent light bulbs due to low cost and easily available & cooling purpose 12 volt brushless dc & XH-M452 as humidity controller. Humidity controller optional because of indian climate has annual Average humidity near about 40 to 70% Relative humidity. For giving the power to hardware system 12 volt 2 amps Ac to dc power adaptor can be used.

XH-W1209 Thermostat Controller- has a temperature sensor, keys, LED display, relay and requires DC 12V power supply. It is an affordable, good quality thermostat controller. Thermostats are devices that sense the temperature of a system so that the temperature is maintained at the desired set point or near to it. NTC temperature sensor allows the module to intelligently control varied electrical devices based on the temperature. NTC thermistor has a negative temperature coefficient, which means the resistance decreases with increasing temperature. It has an inbuilt embedded micro-controller, thus not much programming knowledge is required. The module consists of three switches to configure the various parameters including ON and OFF trigger temperatures. The relay can operate at voltages up to a maximum of 240V AC at 5A or 14V DC at 10A to power on. The temperature is displayed in degree centigrade and with the help of 7-segment display and the relay, the state is displayed with the help of the LED present on the XH-W1209 module [18].

Brushless DC Cooling- Fans are operating at 12V with a dimension of 80x80mm. They are typically found in ATX Computer cases, servers, and other enclosed equipment but they can also be used in a variety of other projects requiring moderate airflow. The fan spins at ~2600 RPM and can move approximately 30CFM. There are two connectors for use the fan, simply connect red to 12V, black to ground [20].

Power adaptor- convenient easy method of power source for install hardware systems 12 volt 2 Amp Power Adapter takes an AC INPUT of 100-240V and gives 12V 2A DC output [19].

XH-M452 Humidity controller- xh-m452 use ST controller and high-precision temperature sensor probe. Good performance and accuracy. Simple wide temperature range, simple design, high mechanical strength. It can be embedded industrial equipment, convenient and fast [18]. Humidity controller is optional.

DEVELOPMENT OF PROJECT

The process of developing the prototype of this project is primarily guided description Outlined in the methodology section. However, the overall development and implementation can be summed up by the process flow as shown in the Figure-1. This diagram describes the Prototype model development phases and functionality of the overall connection for this prototype. There are three processes involved in the prototype development; starting with the assembly of The casing, hardware installation and testing temperature regulation properly The casing, hardware installation and testing temperature regulation properly.

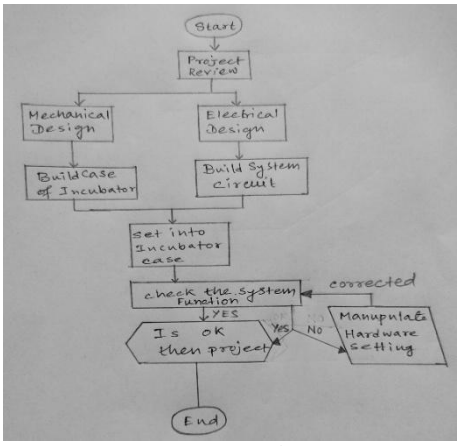

Figure-1. Project flow chart.

Mechanical Design Implementation

The incubator is divided into two parts, the first one mechanical structure second is the insulation compartment which is used for hatching. Outside wall of incubator is made of Paper box ,inside wall made from is Thermocol. All hardware board [3] and power supply unit is attached with outside wall only sensor probe, heating source and cooling source are installed in like a figure-2. Incubation process occurred inside lower part of box.


Figure-1


Figure-2

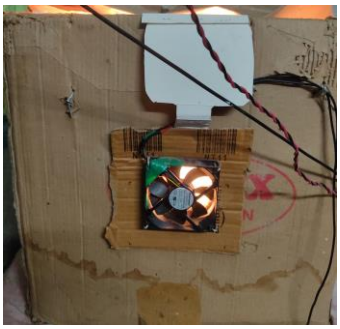
Figure-3

1. Outside controller board for heating & cooling.
2. Inside heating & blower for air circulation Sensor probe to measure Temperature.
3. Outside fan for cooling.

1. Hardware components implementation

Hardware components are installation is important part of this project because if fault occurred during installation it causes hamper the system and system not work properly as requirement. Hardware installation is complete with circuit diagram as given figure-4. Circuit diagram guide, to build

the system and schematic diagram showing part of the incubator system.

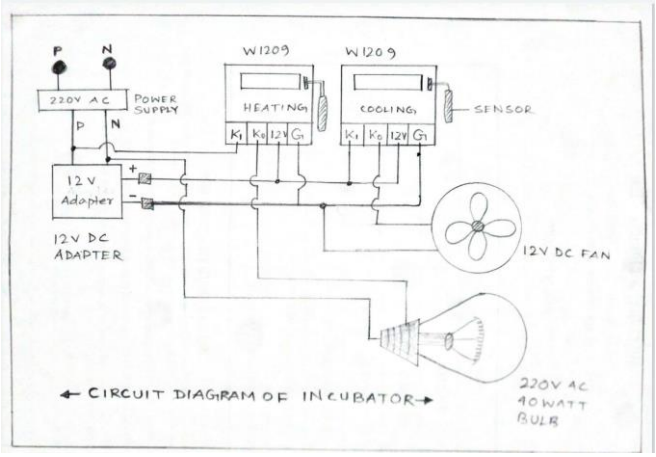

Figure-4. Circuit diagram of Incubator.

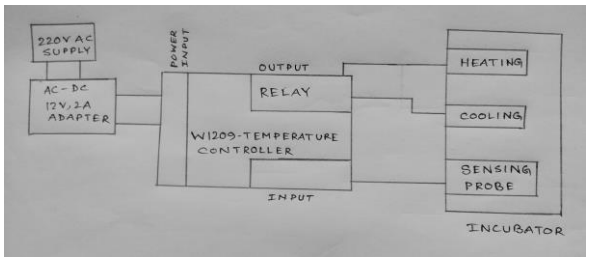

Figure-5. Schematic diagram of incubator part.

Test Incubation temperature setting:-

First connect the power supply to the system then follow the instructions Long press SET to enter the menu display if you would like above 37°C Cooling ON below 36.8°C Cooling OFF

- P0=C ,SET VALUE+P1= Required Temperature value,
- SET value 36.8+ P1 value 0.2=37°C,
- If you would like 36.8° Heater OFF below 36.8° Heater ON then
- P0=H, SET VALUE+P1= Required Temperature value,
- SET value 37-P1 value 0.2=36.8°C.

3. RESULTS

Testing of Incubations rate

In testing purpose of Incubations success rates we have used for first batch of hatching 6 eggs it's buy from Locally so that we not checked the eggs embryos. The types of eggs is randomly buy from available market, so that it's not giving best results for Incubator. After Incubations period we determined efficiency or Incubations success rate (5/6×100)=83.33%[According to testing]

Figure-7:- 1st day of laying Eggs. Figure-8:-Final Results of Incubations.

Figure-7.

Figure-8

Cost analysis:-

We have studies the market values of incubator of different company and different sizes. Some incubator system are iot based, some of very good in technology some of very efficient but also are costly. Our main focus is complete my works with minimum cost because due to covid-19 pandemic huge amount of people lost their jobs and large number of life lost because of malnutrition, it can be minimized by adopting project an Indian rural areas. It will create new sources of income in rural villages areas and increased the protein consumption by rural families, increased hatching to produce large number of chicks with this low cost incubator. Market available incubator price chart Comparison with project Incubator cost is shown figure-7. Here we have not use any eggs Turner it will be manually turned 6-7 time per day and rotate the eggs by human. It was increase hatching capacity at rural villages and self employment opportunities for every families.

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NEW PRICE LIST GENERATED FOR THE YEAR 2018

SR NO	MODEL NUMBER	EGG STORAGE CAPACITY	UNIT PRICE	GST (12%)	MRP	WATTS	WARRANTY
1	PWSI60	60	13,000/-	1560/-	14560/-	120W	ONE YEAR
2	PWSI100	100	16,500/-	1980/-	18480/-	120W	ONE YEAR
3	PWSI200	200	25,000/-	3000/-	28000/-	120W	ONE YEAR
4	PWSI300	300	32,000/-	3840/-	35840/-	130W	ONE YEAR
5	PWSI600	600	45,000/-	5400/-	50400/-	350W	ONE YEAR
7	(PWSI1000)+(PWSI500H)	(1000STR)+(500H)	75,000/-	9000/-	84000/-	600W	ONE YEAR
8	PWSI2000 + PWSI700H	(2000STR)+(700H)	1,30,000/-	15600/-	145600/-	800W	ONE YEAR

Sl No:	SETTER MODEL	UNIT PRICE	HATCHER MODEL	UNIT PRICE	TOTAL UNIT PRICE	GST (12%)	MRP	WATTS	WARRANTY
1	PWSI3000	1,35,000/-	PWSI1000H	55,000/-	1,90,000/-	22,800/-	2,12,800/-	1000W	1 YEAR
2	PWSI6000	2,10,000/-	PWSI2000H	90,000/-	3,00,000/-	36,000/-	3,36,000/-	1800W	1 YEAR
3	PWSI9000	2,60,000/-	PWSI3000H	1,10,000/-	3,70,000/-	44,400/-	4,14,400/-	2500W	1 YEAR
4	PWSI15000	3,02,000/-	PWSI5000H	1,35,000/-	4,37,000/-	52,440/-	4,89,440/-	4000W	1 YEAR
5	PWSI30000	4,52,000/-	PWSI10000H	1,60,000/-	6,12,000/-	73,440/-	6,85,440/-	5000W	1 YEAR

Figure-9 Price list of powersol incubator [21].

Components Name	Range	No of Unit	Cost- (₹)	Remarks
Power supply Adapter	220V AC-12V DC, 2A	1	**132**	Power supply for controller and Fan
DC Fan	12V DC, 1.3 A	2	**144**	Cooling and Air Circulation
Temperature controller	12V DC ,2A	2	**228**	Controller of Cooling and heating system.
Bulb	220V AC ,60W	1	**20**	For Heating
Empty paper cartons	50×45×50cm	1	**50**	Case of Incubator
Insulation thermocol	N.A	2	**60**	Insulated the box temperature.
Bulb Holder	220V AC. 6A	1	**24**	Hold the Bulb as position.
Wire	220V AC, 6A	N.A	**100**	Connect the components
Humidity Controller& Temperature	12V DC, 2A	***	**910*** **	Adjust humidity & Temp controller
Total----	---	----	**₹-698*** **	***Additional

Figure-10 Total Project cost for Incubator.[19,20]

4. CONCLUSION

At the time of implement of Hardware model into Insulation box and checking the temperature control by XH-W1209 thermostat we have to faced different problems with different types of weather, in winter season probably average temperature in India is near about 10°C to 15°C for that time of incubation needs only heating. It is very difficult in heat loss reduces incubator temperature efficiency for that reason better insulation need but considering insulation material cost. And one of the peak summer time average temperature is 29°C to 41°C it's so difficult to maintain incubation temperature 37°C here only cooling system is most important , If outside temperature of insulation box near 40°C then it's not enough for air cooling system, all this fluctuate temperature harm for egg cell and losses will be increase [5,9,12,13] All necessary conditions of weather is main problem with incubator. According to World Meteorological organization India have four region wise categories average annual humidity so it's related to geographically. Average humidity Northern India 50% to 70% relative Humidity, Eastern India 70% to 81%RH, Southern India 56% to 79%RH and Western India 44% to 76% Relative humidity. It's depending on Summer,winter,and Monsoon this factors also affected rate of incubation percentage. This is all are drawbacks of every incubator.

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