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Development of Smart Egg Incubator System Using Arduino

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Abstract:
The purpose of this project is to design and develop the system of an egg incubator that is able to incubate various types of egg, named as Development of Smart Egg Incubator System using Arduino (SEIS). The SEIS will fill up with the humidity sensor that can measure the condition of the incubator and automatically change to the suitable condition for the egg. The health of egg is very important for the development of embryo within the egg. Improper control means that the temperature or humidity is too high or too low. In this project, the bulb is use to give the suitable temperature to the egg. By using the cooling fan, it makes sure the humidity and ventilation in good condition. The status condition in the SIES will appear on the LCD screen display. To make sure all part of egg was heated by bulb, DC motor is very useful to rotate iron rode at the bottom side and automatically change the position of egg. The entire element will be controlled using Arduino. The Arduino is a type of microcontroller that can process data from sensor and will execute the control element to change the condition of SEIS.

Keywords: Egg incubator, Smart Egg Incubator System (SEIS), Arduino UNO, Micro SD Card Module.

I. INTRODUCTION

Incubation is the process by which birds hatch their eggs, and to the development of the embryo within the egg. The most vital factor of incubation is the constant temperature required for its development over a specific period. Especially in domestic fowl, the act of sitting on eggs to incubate them is called brooding. The action or behavioral tendency to sit on a clutch of eggs is also called broody, and most egg laying breeds of chicken have had this behavior selectively bred out of them to increase production. In most species, body heat from the brooding parent provides the constant temperature, though several groups, notably the Megapodes, instead use geothermal heat or the heat generated from rotting vegetable material, effectively creating a giant compost heap. The humidity is also critical, and if the air is too dry the egg will lose too much water to the atmosphere, which can make hatching difficult or impossible. As incubation proceeds, an egg will normally become lighter, and the air space within the egg will normally become larger, owing to evaporation from the egg. Industrial rising of farm animals indoors under conditions of extremely restricted mobility is commonly known as factory farming. It is done as part of industrial agriculture which is a set of methods that changes as laws and technology change are known as industrial agriculture which is designed to produce the highest output at the lowest cost, using economies of scale, modern machinery, modern medicine, and global trade for financing, purchases and sales. Egg incubator is one of the inventions that provide opportunity especially for who want to be excellent farmer. There is one of easy and fastest way that can make a product. This invention will upgrade the egg incubator that has already in the market today. The systems will automatically control the temperature and humidity of the incubator for various types of egg. The function of egg incubator is to take over the animal job to incubate an egg until hatching.

II. EMBRYONIC DEVELOPMENT

Embryonic development is a continuous process that can roughly be divided into three different phases. They are differentiation, growth and the maturation. Typically, differentiation of organs occurs in the first days of incubation. The growth and the maturation of the organs occur in the later phases of development. Each of these phases requires specific incubator conditions. As the embryo grows, its metabolic rate increases and this is accompanied by increased heat production. Consequently, the natural pattern of the embryo and eggshell temperature shows an increase towards the end of incubation. In the incubator we must differentiate between the temperature set point at which the incubator operates and the temperature of the air at the level of the eggs, which determines the temperature of the egg and embryo. At the start of incubation the embryo produces little heat and eggs must be warmed. This means that the air temperature must be higher than the egg temperature. As the embryo grows, metabolic heat production increases and to prevent overheating the air surrounding the eggs must be cooled such that heat is removed from the eggs.

Egg Incubator: Novice poultry producers usually become interested in artificial incubation of their own chicks. The success of this type project depends on proper care and incubation of the hatching eggs so healthy, vigorous chicks are produced. Many times a producer carefully attends to the incubation process but disregards the care of the eggs before they are placed in the incubator. Even before incubation starts the embryo is developing and needs proper care. Hatching eggs suffer from reduced hatchability if the eggs are not cared for properly. The size and type of incubator selected depends on the needs and future plans of each producer. Many different models are available. For continuous settings, separate incubator and hatcher units are recommended. If all eggs in the unit are at the same stage of incubation, a single unit can be used. Locate the incubator and hatcher units indoors to protect them from major weather changes. It is essential that the room has a good ventilation system to supply plenty of fresh air. Keeping the units indoors makes it easier to maintain uniform temperature and humidity. There are basically two types of incubators available, forced-air and still-air incubators. Forced-air incubators have fans that provide internal air circulation. The

capacity of these units may be very large. The still-air incubators are usually small without fans for air circulation. Air exchange is attained by the rise and escape of warm, stale air and the entry of cooler fresh air near the base of the incubator. Recommended temperatures vary between the two incubators, so follow the manufacturer's recommendation that accompany the units.

Incubating Conditions:

The condition of incubator is very importance element. Poor results are most commonly produced with improper control of temperature and/or humidity. Improper control means that the temperature or humidity is too high or too low for a sufficient length of time that it interferes with the normal growth and development of the embryo.Poor results also occur rom improper ventilation, egg turning and sanitation of the machines or eggs. The components than must be control in the incubator are temperature, humidity and ventilation. The temperature must depend on the types of egg. In order to hatch a good percentage of fertile eggs, an incubator must be able to maintain a constant temperature. Though different sorts of eggs require different heat levels, most will grow and hatch well at 99 to 101°F. Sure, that does sound imposingly precise, but such accuracy isn't all that difficult to achieve. Rarely is the humidity too high in properly ventilated still- air incubators. The water pan area should be equivalent to one-half the floor surface area or more. Increased ventilation during the last few days of incubation and hatching may necessitate the addition of another pan of water or a wet sponge. Humidity is maintained by increasing the exposed water surface area. Ventilation is very important during the incubation process. While the embryo is developing, oxygen enters the egg through the shell and carbon dioxide escapes in the same manner. As the chicks hatch, they require an increased supply of fresh oxygen. As embryos grow, the air vent openings are gradually opened to satisfy increased embryonic oxygen demand. Care just be taken to maintain humidity during the hatching period. Unobstructed ventilation holes, both above and below the eggs, are essential for proper air exchange.

III. METHODOLOGY

The project development was divided into three main parts. There are mechanical design, electronic design and software design. So, when combined together all part will be performing the SEIS. In mechanical design is focus on to make casing using hardwood. For electronic design focus on built the system circuit. Besides that, in software is focus on program the system using Arduino.

Figure.1. Flowchart of Project Development

Mechanical Design:

In mechanical design is focus on construction of the SEIS. It starts with the built of the casing. The material was used are hardwood. It is because, is preferable rather than softer wood. The Smart Egg Incubator can fill up to 20-25 eggs. 2 bulbs were placed around the wall inside of the Smart Egg Incubator. The bulb usage is 40 Watt's that supply heat to the egg. There are two layer for the Smart Egg Incubator that call first layer and second layer. First layer is where amount of egg were placed. It is main casing with the egg tray, bulbs and fan. For the second layer, it is for the controller system. It will control the temperature, fan, bulbs and humidity.

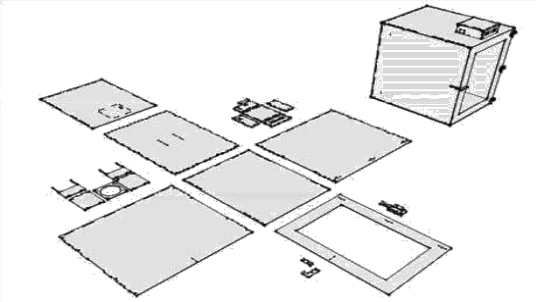

Figure.2. The casing box for Smart Egg Incubator

Software Design:

The maximum temperature in Smart Egg Incubator is 37 °C and the minimum temperature is 35 °C. Lamp will be on until the temperature achieves 37 °C. At 37 °C, the lamp will be off and the fan will be on until temperature decrease to 35 °C. At 35 °C, the fan will be off and the lamp will on until the temperature increase to 37 °C. So, the range of temperature in Smart Egg Incubator will be maintained between 35 °C to 37 °C. The lamp is used to increase the temperature in the system. The fan is used to decrease the temperature. To maintain the temperature in system, lamp and fan will be turn on and off. It is controlled by using Arduino.

Electronic Design:

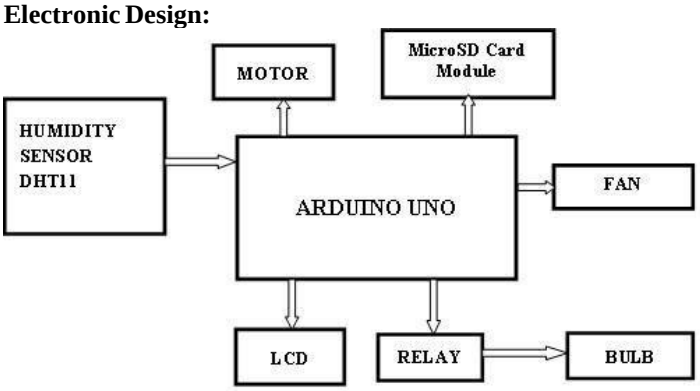

Figure.3. Bolck Diagram

COMPONENTS USED

1. Arduino UNO.
2. DC Motor.
3. Relay.
4. LCD 16x2.
5. Bulb.
6. Cooling Fan.
7. Humidity Sensor.

IV. CONCLUSION

The component designed is easy to maintain, affordable and portable. The SEIS also can hatch different poultry eggs

within a similar range, such as turkeys, ducks, goose, guinea fowl, quail and ostrich. Recommended for household use, subsistent poultry farmers to increase the production of poultry products. Besides that, another recommended is the solar energy. It should be used as backup power supply, because of the failure of electricity to enhance the efficiency of the system .Table 1 shows the temperature and humidity at which the eggs have been kept for hatching process.

Table.1.Temperature and Humidity

Temp	Hum	Bulb	Fan
69	55	Bulb ON	Fan OFF
69	50	Bulb ON	Fan OFF
71	48	Bulb ON	Fan OFF
77	41	Bulb ON	Fan OFF
84	30	Bulb ON	Fan OFF
84	29	Bulb ON	Fan OFF
87	15	Bulb ON	Fan OFF
89	15	Bulb ON	Fan OFF
91	13	Bulb ON	Fan OFF
91	13	Bulb ON	Fan OFF
93	12	Bulb ON	Fan OFF
93	12	Bulb ON	Fan OFF
93	12	Bulb ON	Fan OFF
93	12	Bulb ON	Fan OFF

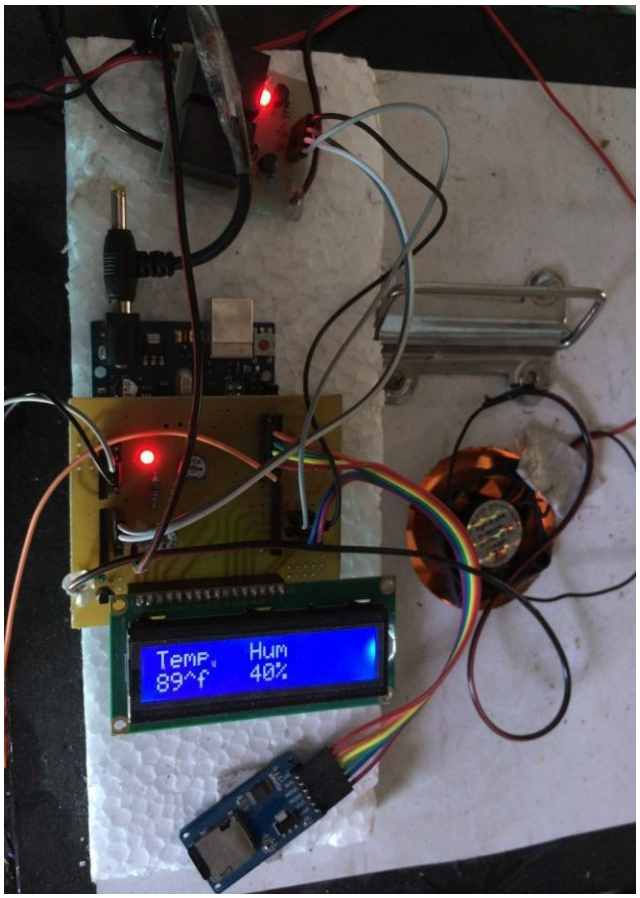

Figure.4. circuit

Figure.5. Inside the Incubator

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