

ARTIFICIALLY INTELLIGENT TEMPERATURE MONITORING SYSTEM FOR PRUDENT BROODING

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Abstract— Artificially Intelligent Temperature Monitoring System for Prudent Brooding is a system that make efficient uses of resources at disposal to increase the body temperature of the chicken. Instead of heating whole poultry as an atomic structure, the system intelligently uses machine learning to punctiliously detect the areas to be heated and the temperature to which it has to be increased in order to make the situation most favorable to the chicken in poultry and thereby the farmer. In addition, system is designed to maintain the air quality of the plant to reduce excessive concentrations of air pollutants such as ammonia and carbon dioxide which, in contrast to the conventional energy, primarily uses solar panels reducing the farmer energy consumption overhead and thus, help in reducing carbon footprints.

Key Words: Artificial Intelligence, Brooder, Poultry farm, Brooder, infrared camera, image processing, raspberry pie, monitoring, Relative humidity, Chicken, etc.

1. INTRODUCTION:

In a country like India which largely depends on primary industries for income of the majority of population, poultry not only serves as a secondary income, but also primary source of bread for many families. Though India stands leading tech service provider on a global platform, it will not be inappropriate to say, as a broad overview at least, rarely any efforts are made to bring this technology to the basic industries that are serving as pillars of the economy. Many experimental setups and establishments are still struggling to bring effective and efficient technology at a cheap price. Poultry, a sensitive business frequently affected by natural conditions and calamities often suffer huge losses because of failure to maintain optimum conditions. No other infrastructure tools in this business costs as much as brooder (heating system). Even slightest changes of infinitesimal temperature range also result in onerous losses for a small-scale farmer due to the ill growth of the chicken, sometimes, death. As the life of a chicken gradually increases, it becomes more crucial to maintain body temperatures of chicken as it affects the intrinsic trends of reproduction rates and efficiency. Not to mention other factors increasing the operating cost of the system such as increased fuel prices and

transportation cost, vaccinations and diet. Thus, we propose a novel approach to reduce the cost of brooding and increase the productivity of the business as a whole with state-of-the-art system that is a unique mesh of Artificial Intelligence, Machine learning coupled with real-time temperature monitoring as well as conditioning that uses least power for optimal results.

2. ALTERNATIVE BROODING SYSTEMS

2.1. GAS BROODER

Gas brooder uses LPG gas as a fuel for heating operation. If we consider the components used inside this farm then we have sensors, exhaust system, control panels, etc. This system is also becoming the autonomous system but the only defects is that this system cannot provide necessary cooling and heating with the precise value. If we consider towards the cost it is most expensive system which is not affordable for the common farmers. As this is fully automated system there is no need of extra man power but there is problem of improper electric supply in rural areas so it can cause stopping of system. Continuous increase in the price of LPG gas cylinder affects the working cost. [4]

2.2. RADIANT TUBE HEATER

This system is based on the radiation of the heat. Radiant tube is use for the heating purpose. It covers large space with radiant heat. Require less amount of power. Floor area can't require as system installed at the sealing. The simple exhaust system can be use. Disadvantages are possibility of overheating, temperature variation along the tube length, discontinuous power supply can cause problem. And this system cannot detect the exact temperature of chickens required and also the proper maintenance is required if the dust get collected over the tubes it acts as insulation and the heating is been blocked. [5]

2.3. SOLAR HEATING SYSTEM

It can be said as the most convenient way of the brooding system, as it uses the solar power. Black absorber is used to concentrate sunlight. Which converts the sunlight to heat. Due to renewable source of energy this system is eco- friendly. Energy can be stored and used whenever it requires. But it has some limitations as, high initial cost, maintenance require, accessories cost, temperature variation may occur due to change in climate.

2.4. UNDER FLOOR HEATING

This system depends on conduction, radiation and convection as means of heat transfer. Under-floor heating system are using underground electric heating and underground pipes for heat transfer. This system requires external boiling and cooling system as it provide heating and cooling. But this system requires more space and high installation cost. [8]

2.5. TROMBE WALL POULTRY CHICK BROODER

Trombe wall form an integrated part of the house duly oriented south ward for maximum solar energy collection all year around this is made of 0.22 m thick solid block to form the thermal storage system external surface of wall which is expose to environment is treated with black paint for the absorption of radiation energy from sun. Glazing through the glass reduce excess heat loss from long wave radiation. [10]

2.6. KEROSENE BROODER

Kerosene brooder plays important role in rural and remote area. This system requires 40 lit kerosene per day for approx. 1000 birds. Lamps are used in kerosene brooder for brooding operation. It creates health issue for chicken. Also, availability of kerosene may create problem. Requirement of cost is more.

2.7. POT CHARCOAL BROODER

In this brooder charcoal is used as heat source which applicable to remote & rural areas. Charcoal brooder is widely used since it is easily available & has low cost. In the economic sense charcoal is very efficient fuel. It burns easily & for longer period. Along with such benefits it carries some disadvantages that are, it creates smoke in high quantity which is harmful to chicken's health. In rainy season there is higher possibility that charcoal may get wet due to rain so proper care of storage is needed. Charcoal takes some time for initial heating.

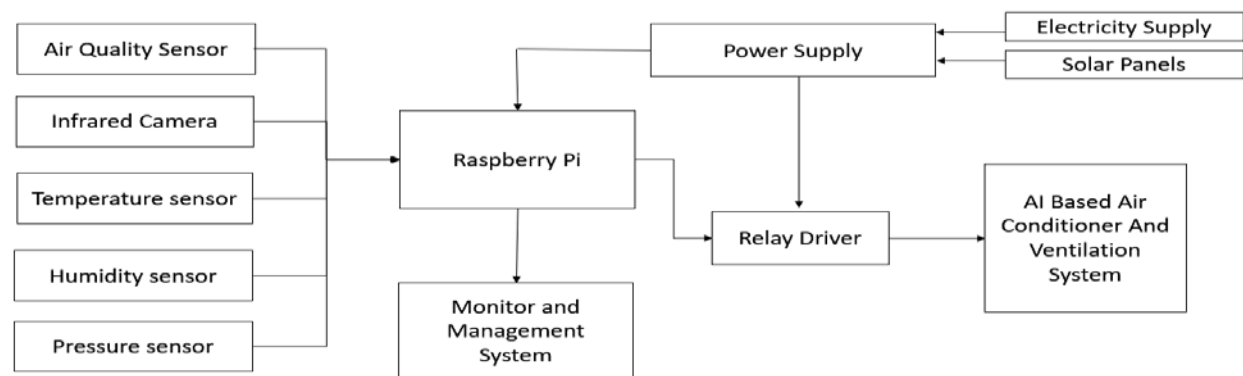


FIG. 1. GENERAL BLOCK DIAGRAM

3. PART DESCRIPTION

3.1. INFRARED CAMERA:

Infrared camera will pick up the images from the surrounding with the infrared data and send it to the raspberry pi controller for the further processing on the image.

3.2. TEMPERATURE SENSOR

Temperature sensor will collect all the temperature data from the surrounding and sensor it to the raspberry pi.

3.3. PRESSURE SENSOR

Pressure sensor is used to detect the pressure. Poultry pressure needs to be analyzed as it is mostly closed atmosphere pressure needs to be checked to keep it safe inside.

3.4. HUMIDITY SENSOR

Humidity sensor detects the water vapor content in the air. Humidity in the poultry can increase due to presence of water and varying temperature in the poultry. If humidity is increase then owner needs to be alerted about it.

3.5. RASPBERRY PI

Raspberry pi is the main controller in this whole system. Data collected from various sensors and detectors is send to raspberry pi for further processing on the data. Precise ai coding is done for every respective sensor and detector to detect the various changes in the environment and take proper required measures to overcomes the undesired changes occurring in real time.

3.6. RELAY DRIVERS

Relay driver job is to cut down the voltage input to the desired required output.

3.7. AIR CONDITIONER

Ai based air conditioning system is used to change the temperature in the poultry as per the raspberry pi instructions.

3.8. MONITOR/DISPLAY

Monitor/display is used the check the data outputs from the sensors and detectors and the overall processing of the pi and the output

instructions given by pi. Also, the errors or alerts if any will be displayed on the screen.

3.9. AIR QUALITY SENSOR (MQ 135)

Air quality sensor is the best option to check the content of gases present in the atmosphere. As it's poultry and have many chickens. The present waste in it and many unseen conditions can cause the air unhygienic. Air quality sensor check the gas contents present in the air so the check if harmful gases like ammonia percentage has increased above the permissible limit.

4. ENVIRONMENTAL PARAMETER NEED TO BE CONTROLLED

Relative humidity (RH), CO₂ and ammonia (NH₃) plays very important role in growth of chicken. Proper ventilation requires to control all these parameters. If RH exceeds above 70% then it will create undesirable effect & RH below 50% creates dust in poultry house. Modern techniques are trying to reduce heat losses for maintaining temperature of poultry farms. Due to this CO₂ is formed. Gas heater helps in formation of CO₂ & also birds create their own CO₂. High level of NH₃ create impact on growth of the chicken. It reduces rate gain of weight of chicken. Different rate of NH₃ production in farm gives different rate of growth. Various factors affect the rate of production of ammonia i.e. Ambient temperature, ventilation rate, humidity, composition of food etc. [15]

4.1. RELATIVE HUMIDITY: -

Relative humidity of over 70% is undesirable and should be contained through use of ventilation. RH level below 50% result in higher production of dust and air born microorganism. During summer bird experience discomfort due to high relative humidity combined with high temperature. [15]

4.2. CARBON DIOXIDE: -

Modern poultry housing is designed and constructed to reduce heat loss and improve energy Efficiency but when combine with reduction in ventilation to prevent loss of heat energy. This can result in increase in amount of CO₂. Two main sources of CO₂ are from gas heater and from the bird themselves. [15]

4.3. AMMONIA: -

Increase in NH₃ concentration level in poultry can be caused by high moisture level along with high temperature which promote bacterial growth & cause organic material to decompose. NH₃ level should not exceed 20ppm over 8hr period or 35ppm over 10 min period during poultry production cycle. [15]

5. NEED OF EXHAUST SYSTEM

In order to reduce energy loss, the ventilation is avoided in traditional method but it results in increase in CO₂ and RH which effect on growth and development of chicken. So as to avoid it proper exhaust is needed in poultry farm. It is necessary to throw NH₃ out of poultry farm in order to avoid microbial growth.

6. METHODOLOGY

Initially infrared sensor will capture the images from the poultry and send the infrared captured data to the raspberry pi. Simultaneously the humidity sensor, pressure sensor, air quality sensor, temperature sensor will be sending the respective data to the raspberry pi as well. Raspberry is the main essence of this whole structure. This will check the all infrared data from the infrared camera and check the body temperature of the chickens in the poultry. Temperature sensor will check the atmospheric temperature. Now the raspberry pi will use the AI coding for checking the present condition and the permissible limit at the poultry and give the required instruction to the output so the further action can be taken to overcome the undesired change.

7. WORKING

Firstly, the data from the IR camera is taken by the raspberry pi this data is been sorted and then the certain patch is been taken into evaluation. This patch is in the jpeg/jpg format. The patch is having certain color pigments, this pigment decides the temperature range of the body. As the range is been decided by the user if the temperature value goes below that value the controller sends the signals to the relay driver this driver operates the ai based air conditioning system. This ac system is been operated according to the need of the temperature. As when the body temperature goes below setpoint then ac provides the heated air and

when the temperature goes above the setpoint then the ac provides the cool air. In this way the temperature in the poultry farm is been maintain according to the need. For the reference of the temperature the temperature sensor is been put to measure the ambient temperature. Which is nothing but the outside temperature of the room.

As the system is partially closed thus the air quality inside the farm also get poorer the contains such as the ammonia, carbon dioxide and humidity is also gets changed. In order to maintain this value under a certain limit here we use the humidity sensor, air quality sensor, pressure sensor which brings the data of relative humidity, quantity of ammonia and carbon dioxide of the atmosphere and as this value is also preset inside the controller. When the sensor detects the given data by the sensor above a certain value the ai based ac system open the vent and removes the over polluted air from the farm and brings out the comfort to the chicken. In this way the whole comfort system works. The system uses dual power supply which is used to maintain the operation of the invention even if the power is cutoff as it is the general problem in the rural area. The solar panels are used as an alternative source of power.

8. PARAMETER WHICH TO BE CONSIDER TO REDUCE THE HEAT LOSS OF POULTRY FARM

- 8.1. Avoid air leakage
- 8.2. The roof and wall should be fully sealed
- 8.3. Providing well sealing brooding curtains
- 8.4. Minimizing over ventilation
- 8.5. Monitoring abnormal heat rate of consumption
- 8.6. Enhance insulation: it is used to reduce heat transfer i.e. Heat gain in summer and heat loss in winter
- 8.7. Regular maintenance and inspection of heating system

9. CONCLUSION

- 9.1. As the system uses the AI technology the dependency on the human reduces and the proper care is to be taken.
- 9.2. System depends on the AI based air conditioner the proper ventilation is been provided.

- 9.3. System becomes more convenient and economical as this does not require the man power.
- 9.4. The building of the smoke and other harmful gases reduced due to this system.
- 9.5. Proper distribution of the heat is been carried out due to special AI based system.
- 9.6. The system does not require any special skills to operate as it is autonomous.
- 9.7. An alternative Source through solar panel is provided to this system, so that the power cutoff does not affect the system.

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