Remote Monitoring and Control of Poultry Farm using IoT Techniques

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Abstract—**The environmental conditions monitoring and control's ability is crucial and demands a good level of research in fields ranging from the change in climatic conditions in agriculture and zoology. According to world's agricultural produce survey, chicken is among the most favorite produce, since it is a nutrient rich food providing high protein, low fat, low cholesterol, and low energy than other kinds of poultries.**

From last few years worldwide, there has been an increased level of awareness regarding the safety of food products like chickens and there has been a high demand for good quality and quantity chicken food. This research focuses on the integration of wireless sensors and mobile network with a well known sensors integration platform using remote sensing. System initiates the action automatically to control the environmental parameters such as humidity, temperature, ammonia gas (NH_3) then, the control will be based on the set threshold value when there is a sudden change in climate. The proposed solution will decrease the environmental diseases affecting chicken and increase the productivity and eliminate a lot of manpower who can make some human errors. The method can care also about the data analysis.

Keywords— *Arduino, Sensors, IoT*

I. INTRODUCTION

Automation is increasingly important in modern agriculture, reducing dependence on labor and liberating farmers from constant work, increasing management scale and efficiency, fulfilling the precision and consistency of product quality control, enabling enforceable traceability as part of food safety efforts – all of which can help achieve agricultural sustainability [10]. Poultry farming is the process of raising domesticated birds such as chickens, ducks, turkeys and geese for the purpose of farming meat or eggs for food. This research focused on modern technologies for poultry farming to control all environmental parameters like temperature, humidity, ammonia gas that affects on the growth of the chickens. If the environmental condition is not up to the mark then there may be harmful for digestive, respiratory and behavioral change in the chickens. If chickens may get suitable atmosphere and proper food then it may grow rapidly and health of chickens will be good so their weights will increase. Climate plays quite important role in the growth of the chicken.

A hatched chick cannot maintain a proper body temperature without help. In the first three weeks of its life, a chick should not be exposed to cool temperatures. Exposing the young bird to cool temperatures (20°C) for a day or two on the farm can cause the bird to die from heart problems later. Hence, heated premises are a must for brooding. Temperature should be reduced by 3°C per week, until the room temperature of 20°C is reached. After six weeks of age, desirable -temperature range in 18 to 21°C. The most widely used source of heat, is a heat lamp for small flocks of birds [1].

In poultry farm production, humidity and air pollution are critical; during the summer season, birds experience discomfort due to high humidity combined with high temperatures. High CO_2 levels result in lethargic chicks with reduced weight gains, while high ammonia gas (NH_3) level result in poor feed conversion, reduced weight gain and increased susceptibility to disease. Smart poultry farm can be designed in way that the humidity and air pollution can be controlled by ventilations, cooling and heater.

Within this paper, the parameters, like ammonia gas, water level, humidity and temperature are monitored and controlled using microcontroller. The transmitted data should be received by receiver and then transmitted to the ESP8266 module through the microcontroller. Data can be saved on cloud for better analysis.

II. RELATED WORK

Based on the poultry farm management perspective, the modern technologies had been used to monitor and manage poultry farm for better production improvements.

O. M. Olaniyi, et al suggested the low cost of production and high human involvement in poultry farms, could lead to low profit and low return on investment. These flaws in the poor feeding system of chicken prompted this work by developing an intelligent fuzzy logic based system that could mimic the roles of the poultry labors in delivering water and feed food for birds at specified time of intervals. Water and feed level id sensed by the designed system and dispense intelligently with respect to the variations in water and feed level as chicken consume the water and feed. This system reduces workload of the poultry attendants, increases cost

benefits and generates good returns on investment in poultry farming system [2].

Sneba. M. et al proposed an integration of wireless sensors and mobile system network to control and monitor following environmental parameters: temperature, relative humidity, air impurity levels in a poultry farm. They used DHT22 sensor module for temperature and relative humidity, MQ135 sensor module for air pollution level all of those measurements are remotely monitored through the internet. The remote monitoring is achieved by means of a computer system that acquires values sensed by sensor and communicates the same to a smart phone connected to the internet [1].

Mohannad Ibrahim, et al described an approach to build a cost-effective standardized environmental monitoring device using the Raspberry-Pi (R-Pi) single-board computer. The system was designed using Python Programming language and can be controlled and accessed remotely through and Internet of Things platform. It takes information about the surrounding environment through sensors and uploads it directly to the internet, where it can be accessed anytime and anywhere through internet. Experimental results demonstrated that the system is able to accurately measure: temperature, humidity, light level and concentrations of the carbon monoxide harmful air pollutant. It's also designed to detect earthquakes through an assembled seismic sensor [3].

Rupali B. Mahale et al discussed about monitoring poultry farm by using Wireless Sensor and GPRS based Network. This system monitors the water, food level and surrounding environmental parameters of a poultry farm including temperature and humidity. Through this system the person in charge of poultry farm can get internal environment of a poultry farm at anytime and anywhere with the help of GPRS network [4].

Divyvani Palle, et al proposed measurement and control of humidity and temperature that play an important role in different fields like Agriculture, Science, Engineering and Technology. Also it becomes essential to monitor the real-time weather condition of one place from another place [5].

Ms. Minal Goswami, Kirit Bhatt presented the design and development of CC3200-based Claud IoT for measuring humidity and temperature. CC3200 is the first SimpleLink WIFI internet-on-chip LaunchPad developed by Texas instruments, USA in 2014. The HRT393 sensor is used for measuring humidity and temperature. Measured parameters are sent to the Cloud servers of AT&TM2X Cloud technology (HTTPS). Humidity and temperature measurements made in real-time are shown graphically. The software is developed in Energia integrated development environment (IDE) [6].

K. Sravanth Goudet et al elaborated the advanced technique of wireless sensor network and mobile network to control and automatically monitor the environmental parameters of poultry. The environmental parameters can be monitored by sending SMS back to the system. These parameters are like temperature and humidity. If system does not receive command from registered mobile number, then it

will automatically perform its action. Hence by using this modern technique system can provide a modern technique for farm automation [7].

Gerard Corkery et al discussed about using smart sensing technologies into the poultry industry to monitor critical environmental parameters which are relevant to poultry production include inter alia air temperature, relative humidity, light, air speed and air quality (in particular CO_2 and NH_3 concentrations). Current industry practice with regard to the measurement of these parameters in addition of the effect of these parameters on bird welfare is reviewed. Hence they reviewed about this smart sensing technology in the poultry industry [8].

Siwakorn Jindart et al have designed an intelligent system over the embedded system and smart phone for poultry management. To solve the problem author used Paspberry Pi and Arduino Uno. This system should monitor the surrounding parameters of poultry environment including humidity, temperature, climate quality, the filter fan switches. This system is found very simple and useful for formers, as they can effectively control the poultry farm at any time and from anywhere [9].

The proposed system can be grouped into different units based on the size of the shelter. Sensors are connected to the Arduino board; coolers, heaters and ventilations are functioning automatically without human interaction, and all sensed data are sent to the cloud and owner or users can get information of the poultry farm in real-time.

III. PROPOSED SOLUTION

The design below comprises internet based system which includes remote sensors and Arduino Mega board and controller. The system can generate real time based environmental based data to the cloud. The user also controls the mechanical systems (fans) to adjust or stabilize the poultry farm.
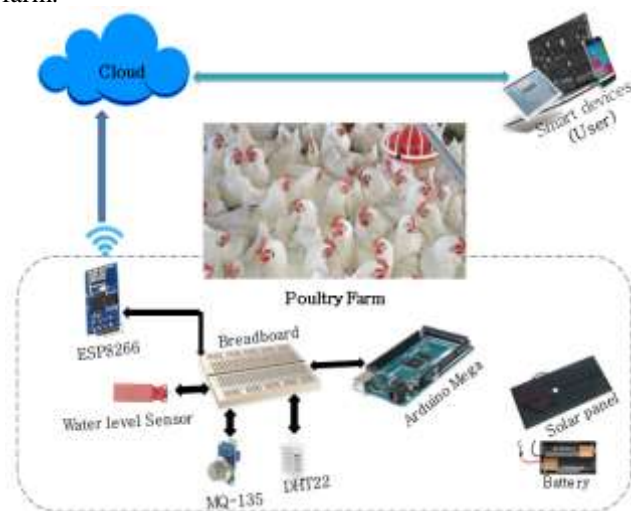

Figure 1: Concept Diagram

Based on the above diagram, some mechanical components have been omitted, those components include: Exhaust Fan, Heating Fan, Cooling Fan...

IV. FLOW CHART

The flow chart explains the functionality of the working model. The system monitors and read all environmental parameters in poultry farm by Atmega324A microcontroller.
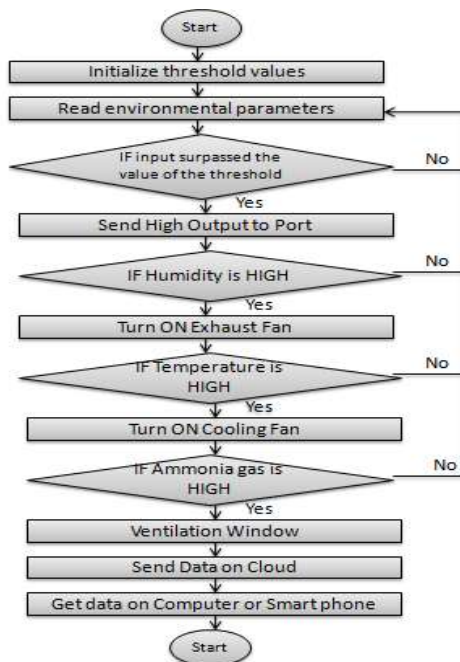

Figure 2: Flowchart of the system

MQ-135 gas module sensor is used to manage the air pollution, it is suitable for detection of NH_3, NO_x, alcohol, Benzene, smoke, CO_2, etc. Among those gases, Ammonia and CO_2 are one of the parameters which affect the chicks and chicken in their growth. By using MQ-135 sensor, the said gases are filtered and the threshold values for each gas are set and once that values is exceeded, the alarm will be notified and also it will trigger the ventilation fan to stabilize the air, else if the minimum amount of ammonia gas and CO_2 exceeded, the sensor will turn OFF the ventilation.

The system uses dht22 module sensor to detect temperature and humidity. To control the temperature of the shelter (poultry farm), as the normal temperature for chicken and chicks is known ($18^{o}C$ to $21^{o}C$), sensors arrange themselves so that the room temperature is set around that values. In the summer season or on the sunshine day, the temperature can exceed the normal one, when it exceeds, the sensor will trigger the cooling fan so that it can be ON. When the temperature goes below the minimal normal value (in winter or in the rainy season or during the night), the sensors will turn OFF the cooling fan. The humidity also is managed in the same way as the temperature, with its own min and max values for better management.

After managing the environmental conditions, it is known that chickens drink water a lot, the concern is to make the system somehow automatic, for reducing the manpower. The baskets where chickens use to drink water, there are installed in such way that the water level sensors will track the movement of the water in the tank. When the water level reach at a min values set on the sensor, it will switch OFF the tank pump to avoid wastage, and as well when the filled water is finished by chickens, sensors will track that shortage and turn the pump ON and so on.

Arduino MEGA 2560 micro controller board is used to connect and manage all sensors said above. ESP8266 board is also used to add WIFI local networks to allow all measured data sent to a centralized database or to the cloud to help users or owner of the farm controlling and monitoring the nutrition and environmental condition of his poultry through the computer or any smart devices. Data gathered can play an important role in the society especially for business people focusing on the investing in the poultry farm and also the ministry in charge of Agriculture and Animal Resources for advising farms for climate management.

V. CONCLUSION

IoT is an innovative technology for Zoology environmental condition management especially poultry farming which can be changed from the routine traditional farm into smart automated poultry farm. Various environmental parameters have been continuously monitored to improve health and growth of chicks and chicken. Water control mechanism helps to provide time to time water supply to the chickens as well as help to avoid the wastage of water. Usage of IoT helps the farmer to monitor the internal environment of poultry farm and also get all details about the farm from anywhere and anytime.

Usage of mobile devices especially smart phone can help the farmers to monitor the internal environmental condition of poultry as well as updating data on web portal.

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