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IOT based Automatic Control for Embedded Poultry Farm

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ABSTRACT: Many poultry farmers are performing diverse operations manually. They, therefore, experience a huge financial loss as a result of their inability to properly automate the monitoring and control of environmental factors such as temperature, humidity, air quality, and to ensure an adequate supply of light and water. These factors adversely affect the chicks and lead to respiratory, digestive and behavioral disorders. This affects the chicks' food intake and leads to an increase in mortality rate and chances of diseases. Therefore, this paper seeks to address these factors by developing an embedded poultry farm. The system was developed using microcontroller and sensors as the major components used for the design. The system when tested was able to sense environmental parameter status and respond accordingly to regulate and maintain an optimum condition for improved health condition for the chicks. The Proposed system is applicable in Poultry Farm to feed the food in container, maintain and regulate the temperature. The automated system will help for the purpose of improving productivity and environmental or climatic conditions in the poultry farm, making it conducive for the broiler chicks.

KEYWORDS: Automation, embedded system, microprocessor, monitoring.

I. INTRODUCTION

An embedded poultry farm is a poultry farm which has a reliable system that is capable of automatically regulating the variables that affect the wellbeing of a poultry farm. Such variables include climatic conditions, water supply system, lighting system, etc. The bid to ease labor and increase productivity in poultry farm has given rise to the emergence of automated poultry farms. According to the Food and Agriculture Organization of the United Nations (FAO), chickens are the largely domesticated birds and their meat represent in the region of 88% of global poultry meat output. This work is focused on broiler chicks in particular. Bird wellbeing depends largely on several environmental or climatic parameters that affect the revenue and the performance of the production such as laying time, egg weight, and average broiler weight. The henhouse (chicks' house) should be able to not only measure and monitor but should control the temperature, humidity, moisture, water intake and period of illumination. When the environmental readings do not meet the standard levels, respiratory, digestive, and behavioral disorders probably take place. This leads to reduction in the food intake and eventually increases the mortality rate and chances of diseases. The work proposes a very convenient solution for maintaining an optimum environmental condition by measuring, monitoring and controlling these environmental parameters in order to achieve a relaxing and standard environment for the chicks. The farmhouse automation system based on the Arduino microcontroller technology is designed to manage temperature, relative humidity, automatic lighting and water supply control. There is no comparison between the proposed embedded farmhouse and the conventional method utilized over the years. The performance superiority of the system should be enough to motivate poultry farmers to adopt this technology in their poultry farms[1].

II. RELATED WORK

[2] The users are able to get the internal environmental situation of poultry farm by receiving a message on registered mobile number. The system will initiate the action automatically to control the environmental parameters when there is a sudden change in climate. Water level control and food control mechanism is also monitored and controlled with the help of sensors. All the sensors are connected with the raspberry pi which can control and monitor all data. The detail records of poultry farm with an environmental condition is later viewed on a webpage. The work was implemented using Raspberry Pi, which is a high performance, low power processor. LM35 Temperature Sensor, SY-HS-220 Humidity Sensor, MQ135 Sensor used for detecting Ammonia Gas, MQ Smoke Sensor, Level Sensor for monitoring level of water. These signals are feed to Analog-to-Digital Converter (ADC) MCP3204 which converts them to digital form. The system designed provides an efficiently automated poultry farm monitoring system for the

healthy atmosphere for chickens without human interference. The farmer can monitor real time environmental contexts such as temperature, humidity, ammonia gas and water level using smartphone application. The work, however, has some limitations which this work also seeks to address. The system has no provision for sustainable lightening system. Raspberry pi is costlier and less easy to set up compared to Arduino Uno which can also be used to implement the system. Automated control system for poultry farm based on embedded system is proposed in [3]. Here, wireless sensor network is used to collect information in the poultry farm. LM35 temperature sensor is used to take the temperature measurement. Temperature measurement and water level indicator is controlled using the microcontroller. The data is analysed and presented on a graphical user interface (GUI), programmed with LabVIEW. It allows the user to retrieve upto-date information about the environmental factors in the poultry farm and control equipment easily through the SMS gateway. It provides great utility for the user as they can access the information or receive warnings at any location where GSM services exist. The system is labour- saving for the farmer and reports environmental changes immediately, thereby enabling the farmer to take appropriate action. It is also a flexible system as it can be integrated into small and medium-sized poultry farms with minimal modifications. The real time values are also displayed on the LCD. The work also has some setbacks which this work seeks to address. A temperature reading is taken only at one point of the poultry house and therefore could not give the average reading especially for an industrial poultry farm. The humidity control system is not implemented in this work as well as no provision for an automatic lightning system. This paper [4], focused on the wireless sensors for data collection and GPRS network for remote monitoring to automate environmental parameters in a poultry farm. The system is designed in such a way that the parameters; Ammonia gas, water level, feed level, humidity and temperature are monitored and controlled using a microcontroller. Atmega324A is a microcontroller that connects all the sensors while GPRS (General Packet Radio Services) module is used as GSM for remote reporting. This paper is seeking to address the setbacks and limitations of the above reviewed works. The work has implemented a sustainable automatic lightening system which is independent on the heat source. Also, in this work, temperature and humidity readings are being taken from three different parts of the poultry farm in a star topology and the average is gotten which gives a more accurate result on the climatic condition of the poultry farm. The system gives a real time monitoring capability using LCD. It is also an effective, low cost and flexible system which enables it to be integrated in small, medium and industrial poultry farms with minimal modifications.

III. PROPOSED METHODOLOGY

A. *Design Considerations:*

HARDWARE REQUIREMENTS

- System   :   Intel i3 2.1 GHZ
- Memory   :   4 GB
- Hard Disk   :   80 GB.
- Arduino Uno
- Relay
- Water pump
- Sprayer
- Temperature & Humidity sensor
- 12v fan
- Servo motor
- Node mcu (wifi)
- Water sensor

SOFTWARE REQUIREMENTS:

- Operating System   :   Windows 7 / 8 or above.
- Language   :   embedded c
- Tool   :   arduino

B. *Description of the Proposed methodology:*

The proposed system has different units which have been automated in other to achieve a smart poultry farm for broiler chicks. These are discussed below.

A. System Consideration

These include the following; automatic light switching system, climate control system (temperature and humidity control) and water feeder control.

● Automatic Light Switching System

The two meshed openings by the side of the poultry farm allow sun rays to provide the needed illumination during the day. At night, the farmer may want to go into the farm to see the condition of the chicks. This time, an automatic lightening system would be needed by the farmer to illuminate the poultry farm. A PIR Sensor is used to sense motion at the entrance of the farmhouse, such that, when someone opens the door, the PIR sensor senses movement and sends a signal to the microprocessor, the microcontroller then sends a signal to the relay to turn on the light. The light goes off when motion is no more detected.

● Climate Control System (Temperature and Humidity Control)

A fan or a heater will get switched on automatically depending on real time readings from a temperature sensor. A DHT11 sensor is sufficient to provide the required accuracy for in-house temperature readings. Depending on whether cooling down or heating up is required inside the poultry house; the microcontroller decides to switch on the exhaust fan or the heater respectively. It offers comfortable conditions for livestock devoid of boring manual monitoring, with energy conservation. The DHT11 sensor which has a humidity sensor incorporated determines either to humidify or dehumidify the poultry house. The poultry house is humidified when the humidity value from the DHT11 sensor is below the threshold value using an electric jug which produces steam used to humidify the poultry house. The exhaust fan comes on when the humidity is above the threshold value. The exhaust fan sucks out the excess humidity in the air.

• Water and food Supply Control

The system also has a water level sensor which detects when the water level goes below a given threshold value and send a signal to the microcontroller which in turn sends a high output to the pump. The pump is turned on to refill the water feeder. When the water feeder gets to the upper threshold value, the sensor also detects it and sends a signal to the microcontroller to turn off the pump. The water level sensor was recalibrated from the default range of 1 - 1023 to a range of 1-100 using the map function provided in the Arduino library, which was used to achieve better evaluation. A threshold range of 90-10 was assigned to the sensor. Where 90 is the upper limit and 10 is the lower limit. . In poultry farm, it is use to feed the food in container.

B. Hardware System Design

PIR motion sensor, DHT11 sensor and water level sensor are used to collect information in the poultry farm. The collected information or data is sent to the microcontroller (Arduino Uno). The fan, heat source and humidifier which require more than 5V supplied by the Arduino Uno are each connected to a relay which serves as a switch and also shields the microcontroller from the higher voltages (i.e. 12V and 240V used by the fans and other appliances respectively). The lighting system is controlled by the microcontroller in response to the data sent by the PIR sensor. The fan, heat source and humidifier are controlled by the microcontroller through the relays in response to the data received from the DHT11 sensor. The microcontroller turns an LED on or off in response to the data gotten from the water level sensor. The LED comes on when the water level is below a certain threshold value indicating that the pump has been turned on

C.   Software System Design

The microcontroller was programmed using the Arduino C. The programming of the components was done on the Arduino platform. The Arduino platform is an attempt to simplify the process of writing codes without unduly limiting the user's flexibility and also takes care of the unneeded complexities. The Arduino software consists of two main parts: the development environment known as the IDE (Integrated Development Environment) and a core library, both open source. The Arduino development environment is a minimal but complete source code editor. All functions needed for programming were accessed from a set of seven toolbar

buttons or a few drop-down menus. The environment which includes a serial monitor enabled sending and receiving of data from the board, easing debugging without requiring additional software.

- **Android application:**
  Android Application is used to control poultry farm. There are some options to control poultry farm environment. User can give instructions to control the poultry farm and user can check status of poultry farm using android application.

IV. CONCLUSION AND FUTURE WORK

The design and implementation of an embedded poultry farm that will measure and automatically control the climatic conditions in addition to water and power supply of the poultry farm house was successfully developed. The system was designed for a day to 4 weeks old broiler chicks. The real time values of the temperature, humidity and water level are all displayed on an LCD at all time. The microcontroller monitors continuously the measured parameters and regulates these parameters to meet the recommended international standard operating condition for broiler chicks at all time. The automated system will help for the purpose of improving productivity and environmental or climatic conditions in the poultry farm, making it conducive for the broiler chicks. Therefore, this work is recommended for use in an industrial poultry farm. The system can be further improved by adding an intelligence unit.

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