



Smart Poultry Farm Monitoring Using IOT and Wireless Sensor Networks

Rupali B. Mahale
Dept. Electronics and Telecommunication
Dr. D. Y. Patil School of Engineering
Pune, India

Dr. S. S. Sonavane
Dept. Electronics and Telecommunication
Dr. D. Y. Patil School of Engineering
Pune, India

Abstract: From last few years, the chicken production in the world has been increasing gradually because of standardized farming management and good manufacturing practices. According to world's agricultural produce survey, chicken is the most favourite produce, since it is a nutrient-rich food providing high protein, low fat and low cholesterol, and lower energy than other kinds of poultries. From last few days around the world, 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 chicken food. This paper is highlighted the technology based solution for low cost, asset saving, quality oriented and productive management of chicken farming. This study intended to explore utilizing an Intelligent System which used an Embedded Framework and Smart Phone for monitoring chicken farm to control environmental parameters using smart devices and technologies.

Keywords: Raspberry Pi2, Arduino, Sensors, Smart phone, Embedded System

I. INTRODUCTION

India is considered as an agricultural wealthy Country in terms of food and important spot in India as the eggs and chicken meat are critical and rich wellsprings of protein, vitamins and minerals. Poultry gives rich natural excrement and is an essential wellspring of pay and job to a huge number of farmers and different persons occupied with united exercises in the poultry business. Chicken is the most broadly acknowledged meat in India.

The health of chicken depends on the environment in the poultry farm. If the environmental condition is not suitable then there may be problem with growth of the chicken and there health issues. Healthy chicken grows rapidly and having good demand in the market. Poultry farm are design in a such way that, environmental conditions can be altered by providing facilities like ventilation, cooling and lightening on rough, wall and floor. The birds are surrounded by micro level climate and it is very much important for the health of the birds.

This paper proposes the new model by using advanced modern technology to make traditional chicken farming smarter. Smart farm gives the environmental parameter statistics like temperature, humidity, smoke, weather condition etc to the desktop computer through advanced sensors and microcontroller. The farm is connecting with smarter devices like application program, sensors, microcontroller which gives automation to the chicken poultry farming.

II. RELATED WORK

This study focus on the advanced technologies to help and manage chickens in the poultry farm by observing environmental parameters by various ways.

So-In C, et. al has focuses on combine approach of sensor network and mobile devices to control and remotely monitor environmental parameters in a chicken poultry farm. This system allows the owner to monitor the various environmental related parameters like change in temperature, humidity, etc. by sending a SMS to the registered mobile number of owner. The owner can initiate a required action by sending a message back

to the system to perform certain and when the system doesn't receive a command in a particular time period it will initiate the action automatically. Thus the system design provides an efficient automated and smart poultry farm monitoring system. [1]

Islam MS, et. al As there are more than 200 thousand poultry farms in Bangladesh, author has designed the natural gas generators as backup support. It reduces a huge load on the national grid. The power supply to the poultry farms has become uncertain and costly too. Under this consideration, poultry farms themselves can become self sufficient generating their own power from daily poultry wastage. As the power systems in poultry farms are modeled to operate in island mode, the stability of them must be ensured under all operating condition. The aim of this paper is to analyze the stability of a standalone biogas power system under different operating conditions. [2]

Junho Bang, et. al has suggested a LED smart lighting control system for poultry farms. There are disadvantages of the traditional system adjusting incandescent bulbs of illumination, of which energy efficiency is very low as well as high power consumption. So that to overcome such problem a smart control system is applied to poultry farms. This system has several advantages as follows. First, the energy efficiency can be improved in comparison to the existing system. Second, the illumination control range can be improved. The maximum illumination is increased by 10 times more than that of the existing system inside the poultry farm. Furthermore, using the developed smart control system a farmer can manage remotely his poultry farms through real-time environmental monitoring with a PC and smart phone. [3]

Fangwu Dong, Naiqing Zhang, has suggested the real time monitoring requirement of poultry farms on the environment, an online monitoring system is designed for poultry farms on the environment based on ZigBee module. It will provide a network of real time monitoring system, monitoring system involves node controller, data receiver, data transmission and control node, which is TI's CC2430 based on ZigBee interface technology.

CO2 sensors use TGS4161, temperature and humidity sensors use SHT75 to detect different environmental

parameters. Through the analysis of data transmission of system, simplifying the ZigBee protocol stack, designed data transmission protocols and communication formats of the system. [4]

O. M. Olaniyi, et. al has 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 labours 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. [5]

Rupesh I. Muttha, et. al has designed the Poultry farming till now is done manually so farmers are incapable for getting the more benefits. Few years ago the feeding of whole cereals to chickens, as a scratch feed or part of a complete diet, was the regular accepted practice. With the growth of large poultry production, automatic feeding systems, employing for the most part full-fed complete diets, were adopted as the major of choice for feeding. Controlling and monitoring of environmental parameters related to a Poultry farm, so as to ensure complete care of chickens is one of the major work. The objective is achieved through the use of sensor based system. The Poultry Farming through automation using PLC has to form the Environmental Controlled. These Environmental Controlled Poultry sheds are controlled 24 hours through automation. It will provide better output with decreasing the man efforts and also human errors. [6]

Boopathy. S, et. al describes the measurement of different environmental parameters at the poultry farm such as change in temperature, variation in humidity, level of water control and valve adjustment. In this, temperature sensor calibration has been done by help of two-point formula. The level sensor output has been observed with respect to fuel in the generator. From the result of sensor output of the particular instrument has been described. [7]

Drishti Kanjilal, et. al has demonstrated the advance technology. As we know the world around us is getting automated. Automatic systems are being favoured over manual systems, as they are energy efficient and reduce the need for tedious human efforts. A typical farm requires a lot of labour. Automation can moderate the amount of manual human efforts, and make farming easier and faster, leading to more farming growth. The concept of automation is extended to the agricultural farms and green houses.

Numerous aspects of the farm are automated, which include automated irrigation cycles and secure temperature controlled enclosures for chicken and farm products. In our paper, author has implemented automatic lighting system, auto-sprinkler system, in-house temperature management and security for poultry farms. As temperature and motion sensitive devices will only work when needed, such a system conserves energy effectively. [8]

Kumar A, et. al has designed this paper for An animal health monitoring system for monitoring the parameters, such as rumination, body temperature, and heart rate with surrounding humidity and temperature, has been developed. The developed system can also study the stress level related to thermal humidity index.

The Zigbee device and PIC18F4550 microcontroller design are used in the implementation of sensor module. The real-time monitoring of various behavioral parameters can be present

monitored regularly. As this device is very helpful for inexpensive health care of chicken. A standard prototype model is designed and tested with high accurate results. [9]

Okada H, et. al has designed and developed a low power wireless sensor node with regularly monitoring of activity for animal health care monitoring. Operation of body temperature measurement is enough for health care and effective to reduce the power utilization. In this report, it is shown that an ultra low power technique for regular activity measures with a developed customize LSI which works at around 320 nW of calculated power utilization at standby state and a MEMS piezoelectric micro-cantilever. [10]

III. SYSTEM DESIGN

The above design comprises internet based system which includes remote sensors and arduino UNO microcontroller. The system can generate real time based environmental based notification to the remote server such as daily maximum/minimum temperature, humidity, air quality (moisture). User also control the filter fan to reduce the effect of humidity and temperature. Systems also control the water level for chickens by using remotely monitor sensors.

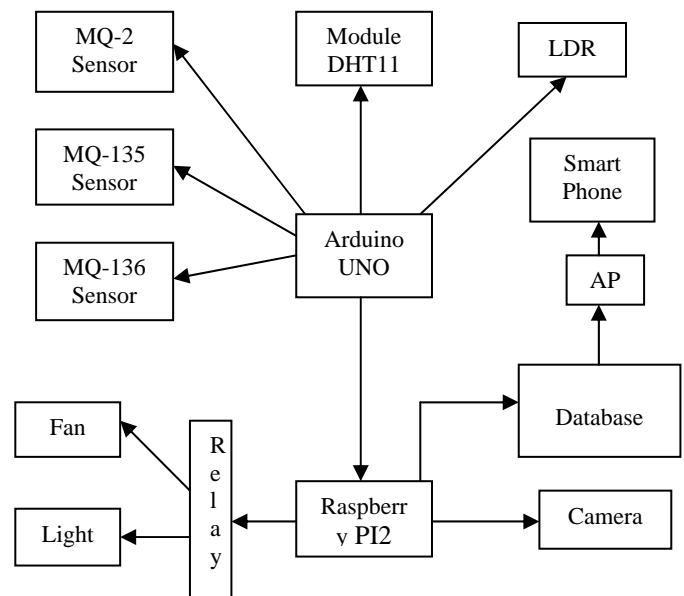


Figure 1. Block Diagram of the System

IV. METHODOLOGY

A. Raspberry Pi2

Raspberry Pi 2 is designed as IoT core small computer installed with Linux and windows operating system which served as personal computer web server, MySQL database Server. Raspberry pi contains GPIO pin which can be used as digital input and output.

B. Arduinio UNO

It is an open-source microcontroller board with serial port interface, digital I/O pins, USB ports. Arduinio provides an integrated development environment based on the processing project, which includes support for C and C++ programming languages.

C. Sensor Modules

The DHT11 temperature and humidity sensor is used to measure the humidity and temperature inside poultry farm, which protects the chicken from the various diseases. The system receives measuring temperature and humidity through the microcontroller. The gas sensor is used to measure NH₃, NO_x, CO₂, Benzene level inside the poultry farm. MG811 sensor is used to detect CO₂ including air quality monitoring. MQ-7 is used to detect carbon monoxide (CO).

D. Interconnections

The Raspberry Pi2 is and arduino UNO is connected via serial communication as full duplex. The Camera is connected via Common System Interface providing fast and real time image transmission. All sensors are connected via arduino UNO board and real time sensors data is transmitted to raspberry pi2. The raspberry pi2 sends the real time notification to the smart phones and stored on remote server.

E. Hardware Connection

UART is use to connect Raspberry Pi2 and Arduino UNO, because of the potential difference between Raspberry Pi2 and Arduino UNO. Raspberry Pi2 required 3.3V while Arduino UNO required 5V. The Connection Between Arduino UNO and Raspberry Pi2 is a serial communication. So that data communication should be two way i.e. Transmitter to Receiver. CSI (Common System Interface) is applying between connection of Raspberry Pi2 and Camera. Fast data transmissions should be provided because of point to point connection, hence required low energy consumption.

The basic command of program MJPG Streamer is copying data from single input to multiple outputs. Image of poultry farm should be occur on Computer through the web browser. Board Arduino is connected with all the sensors, and all receiving data should be transmitted to Raspberry Pi2 From UART. Here the function of Raspberry Pi2 is nothing but the controller. Which observe the working of all sensors and parameters in a poultry farm, observe the working of each parameters and send notification to the registered mobile no. on smart phone and stored a data in a computer as a server.

F. Software

The software modules connects raspberry Pi2 to smart phones and remote database servers. The raspberry Pi2 reads the real time notification from microcontroller, The threshold value (min and max) is set for all sensor inputs. Raspberry Pi2 checked the connection between all the parameters and receiving movements of each and every parameters and send the data to the protocols via IP Address of sockets which should be stored in a server.

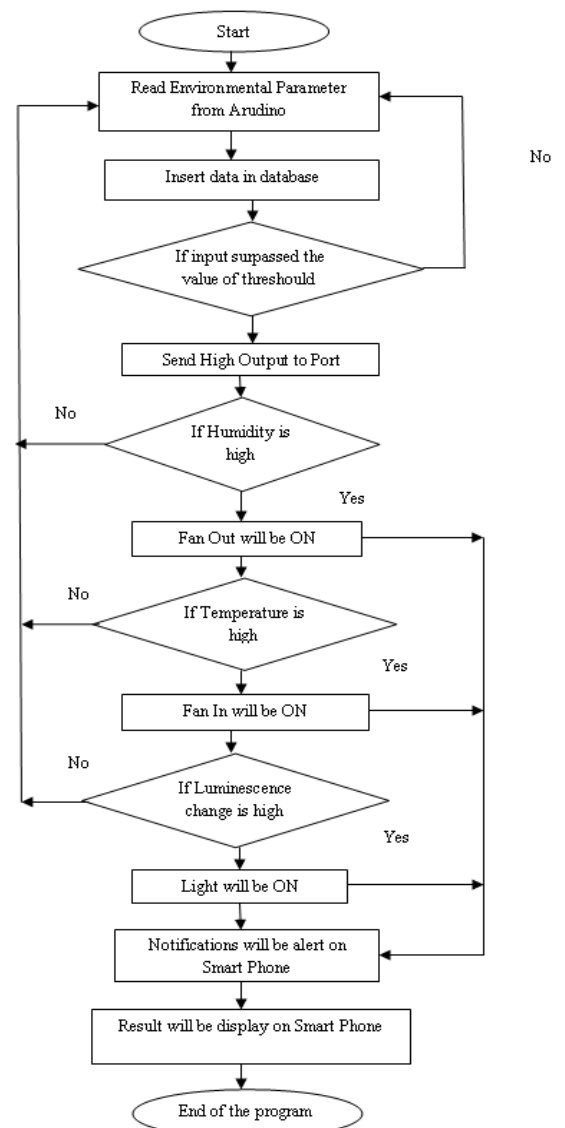
In a software part there are different operating system used, but here we used Linux as a main operating system in Raspberry Pi2. Operating system has been installed in a SD card with the help of an application. Once the installation of SD card has been done then installation of other parameters like configuration of a camera, connections of UART and web server, IP address configuration should be completed.

For the development of Raspberry Pi2 Python programming has applied, the value of Arduino should be read by python

with the help of UART and collect all obtained data information to the database server. When a case arrive to transmit high quality data then first high signal should be send to the 17 pin of GPIO so the ventilation window will get open to removal of internal air in outer air in environment. When there is sudden rise in temperature signal will be send to pin no. 27 of GPIO so that the cooling fan will be ON to maintain the internal temperature in a poultry farm. As we know now a days android application is works in a smart phones. With the help of Java programming languages android operating system is interacted with the Raspberry Pi2 through WSNs.

Android Application take the input values from Arduino and display as a temperature, humidity, gases and light sensitivity. It gives instructions to control fans and lights and can be tracked via internet system

V. FLOW-GRAPH FOR PYTHON PROGRAMMING IN RASPBERRY PI2



The flow chart explains the functionality of the working model. The system monitor and read all environmental parameters in poultry farm by Arudino microcontroller. After reading all data by Arudino, insert data into database. If, input crossed the threshold value then send high output to the port. If, value is below the threshold level then it will again start reading environmental parameters. The three different

parameters for poultry farm, temperature, humidity and Luminescence are monitored by the system. For humidity when the value of humidity goes beyond threshold then FAN OUT will be ON to control the humidity. If, no then it will again start reading environmental data. When temperature crosses the threshold value then FAN IN will be on if not then it will again go to the second step and start reading environmental parameters. If Luminescence change is high then light will be ON, if no it will go back to step number two. All the notifications and results will be alert on Smart Phone. The system will generate alert notification if any value out three will get changed. The smart phone uses android application to display values of temperature, humidity, gases and light sensitivity. The real time values are stored into database table and these values are further used for predictive analysis.

VI. PERFORMANCE ANALYSIS

In this paper we discussed the performance analysis of various environmental and climate parameters which will affect on chickens farm and try to maintained minimum and maximum threshold for controlling the above environmental parameters. Various environmental parameters threshold values set in poultry farm and action taken against change in state of environmental parameters. e.g. The threshold value of temperature is in between 24°C to 32°C. If the temperature is below 24°C then the heater will be ON in poultry farm. If the temperature is more than 32°C, then cooling fan will be ON to maintain the internal temperature of poultry Farm. Similarly for the gases in air like NH₃ (Ammonia) and CH₄ (Methane). If percentage of NH₃ and CH₄ is more than 50% and 40% respectively in both cases open the ventilation window of farm. When intensity of light is more than 45% then according to the climate condition of temperature the light switch will be ON/OFF.

VII. ADVANTAGES

1. This system replaces traditional farm into an intelligent farm.
2. It Provide quicker and accurate information about different parameters to farmers.
3. System Required Low cost, asset saving and productive management in chicken farm.
4. The smart monitoring of different parameter like temperature, light, humidity, gas etc by using wireless sensor network.

VIII. CONCLUSION

The traditional way of chicken farming is replace with the smart and intelligent chicken farming using embedded system based innovative application. It helps the farmers real time controlled and monitoring environmental aware context parameters such as temperature, humidity, air quality, light intensity and controlling filter fan, ventilation window. This smart system can effectively controlled the farm from any location and reduces cost time and man power.

This will improve productivity and quality of chickens in poultry farming. In the future advanced IOT based technologies should be use for monitoring and controlling health related parameters of chicken to improve quality and productivity of

chicken farming, Which will Result into profits for farmers and quality food for human being.

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