Original Article

Smart, Embedded & Effective Solution for Conventional, Small-Scale Poultry Farming System

Kashmira D.P.H. [#1], *De Silva T.* [2*], *Pollwaththage N.* [3*]
[1, 2, 3] *Department of Information Technology, CINEC Campus*
Millennium Drive, IT Park, Malabe, Sri Lanka
[1] *khirushi96@gmail.com*

Abstract

In Sri Lanka, most poultry industries are still managing poultry houses using conventional methods. Thus, the manpower utilization is drastically increased due to this issue, hence, utilized manpower and efficiency is very limited. However, the consumer demand towards the poultry outcome is enhancing day-by-day. Therefore, farmers are looking for advanced technologies to maximize efficiency, productivity, and profitability while reducing the operating costs. Thus, the project is focused on developing a smart and embedded poultry farming system to monitor and control small-scale farming conditions. The integrations of the sensor network and GSM/ GPRS network is implemented to control and remotely monitor environmental parameters (temperature, humidity, and light intensity), watering system, and an egg incubator. If there are undesired variations in the above factors, the system will automatically initiate necessary actions to prevent the bad effect. Also, a warning message is sent through the GSM module to the registered mobile number. Thus, the farmer is able to notify internal changes as soon as possible. Meanwhile, the farmer is able to monitor the status via web applications and mobile applications, and owner can update threshold levels through the mobile application. The automated incubator with an egg moving mechanism is effective for small-scale farmers who are incubating a low quantity of eggs. Thus, the system will help for enhancing animal welfare, food safety, efficiency, hatchability, productivity, and profitability while reducing labor utilization and operating costs.

Keywords: Poultry farm, Incubator, Automation, Microcontroller, GSM module, Sensors

Introduction

The industrial revolution is the most popular and upcoming topic in society with the evolution of the internet. Thus, the system automation concept is one of the main parts of the industrial revolution and technological evolution [1]. And also, it has been emphasized as the future of the Internet and the future of smart technology concepts. The concept of automation is a smart system that connects nearly all internet-enabled devices via the internet to communicate data and provide different services to enhance the quality of life [2]. Hence, most manual systems are integrating with the internet and the latest technologies to provide more effective, efficient, and reliable service to society [3]. Such concepts are helping to minimize unnecessary power wastages, human intervention, operation costs, safety risks, etc [4].

The traditional methods used in the poultry industry is resulting in low efficiency while increasing the tedious labor power and operating cost when compared to the automated systems [5]. Therefore, there is a significant degradation in poultry productivity and profitability. However, the demand for the outputs of poultry farming is increasing day by day and required advanced technologies for farming to maximize efficiency and productivity [4] [6]. Hence, it's required to implement modern technology in the agricultural and farming sector because the operation costs and human intervention, are expected to reduce considerably while efficiency can be enhanced. In contemporary agriculture, automation systems play an important role. Due to the disadvantages in traditional systems, the market competitiveness, and the hectic schedule in day-to-day life, users are looking for effective and efficient mechanisms to adapt to the latest technological developments. The above systems facilitate users to monitor and control the entire automation systems from anywhere, at any time through a mobile application or web application.

As highlighted in the above section, fully automated systems can be used to overcome high operating costs, the headcount of laborers, low productivity issues, and other conventional manual operating issues, etc. Apparently, there aren't affordable and applicable mechanisms to purchase as per their requirements, knowledge, the business procedures, and the financial status isn't sufficient to purchase in-built automated systems currently available in the market since such systems are much complicated and expensive. Thus, the available systems are suitable and used by the large-scale farming companies like "Ambewela" and "CIC" companies to maintain their market demand within the agriculture industry. Small-scale farms consist of 100 – 300 hens (maximum), and each coop contains between 40-50 hens. The stocking density of adult hens in a small poultry coop should be 8-10 birds per square meter (1m2). But in Sri Lanka, the count has increased up to 13-15 birds approximately due to landscape issues.

As per the analysis, poultry farmers are monitoring ambient temperature, relative humidity, and light intensity by postulated methods. For example, temperature of each coop should be around 35°C - 38.5°C, and it's measured manually by looking at animal behaviors and rarely using a thermometer by labors. Since the livestock behaviors are changed upon the temperature variations. For example, when the livestock showed more stressed, aggressive behavior that indicates they are suffering from high-temperature levels. And also, changes in eating and water drinking methods are due to high temperature and humidity levels. Hence, if the temperature value is higher than the optimal value, laborers are manually switched on the fans or spread water all over the coop to maintain the desired temperature and relative humidity. This process required a minimum of four laborers to complete the task. Thus, the efficiency is getting low as a negative impact. Furthermore, the feeding systems are maintained by them at the same time. Thus, the traditional processes are required 6 to 8 laborers per coop to control all these tasks, and it should be monitored at least thrice a day by two supervisors to maintain the proper conditions inside the poultry-houses.

Another key task of poultry farming is egg incubation, and it must be done under optimal temperature, relative humidity, and light intensity by laborers or supervisors [7]. So, there are different types of egg incubators in the market, but they are so expensive and consist of high storage capacity. Since, small-scale farms are incubated between 100-150 eggs per month using conventional methods. Thus, it results in low productivity, profitability, and low market demand. On the other hand, the lack of laborers for working has directly affected efficiency and production, especially with the current pandemic situation. Furthermore, traditional mechanisms, folk wisdom about poultry management are other major obstacles that impact efficiency and poultry development [4]. These manual process increases the operating cost and negatively impact on efficiency, productivity, and profitability.

In essence, the environmental parameters and feeding process should be maintained properly during the brooding, egg incubation, and egg hatching periods. Thus, those parameters are more important for bird health, growth, metabolic process, performances. Therefore, small-scale farmers are seeking methods to survive their businesses and maintain productivity even better than before. Thus, the main intention of the project was to introduce an automated system for small-scale poultry farmers to minimize the problems identified in conventional manual operations. Therefore, the project automated main tasks of poultry farming such as controlling environmental factors, watering system, and egg incubation processes. The automated system is specifically designed for small-scale farmers who are using conventional methods to control and monitor the above-highlighted tasks currently maintained by laborers. Also, the general equilibrium theory is used for the designed prototype of 1m2 hen-house.

Research Methodology

A. Software & Hardware Description

The system is aimed to monitor, control environmental parameters and watering systems that affect the bird welfare, egg incubation, production, and performances of poultry birds. If there are unnecessary conditions in the climate in the farm it will automatically control by the developed control system. The system ensures the optimal conditions for proper growth of hens and chicks, efficient performances of birds, enhance production, and reduce human involvement. Based on the fig 1 and fig 2 the entire system is including mechanical components like water motor, bulbs, cooling fans, servo motor, etc. and some mechanical components are omitted including exhausting fan, heating fan, Peltier.

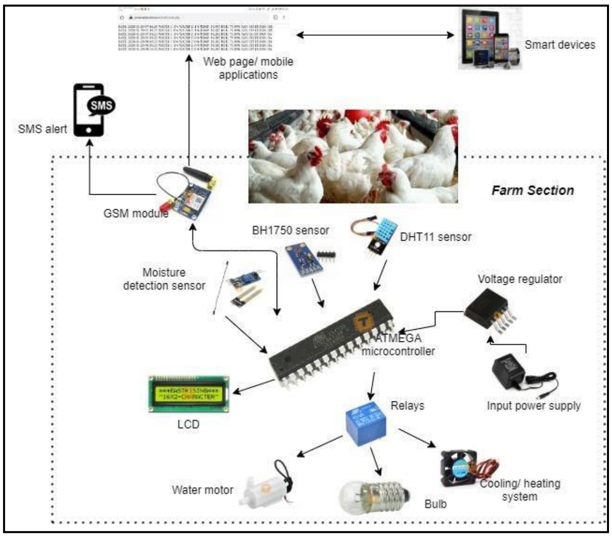


Fig 1: Conceptual Diagram for Farming section

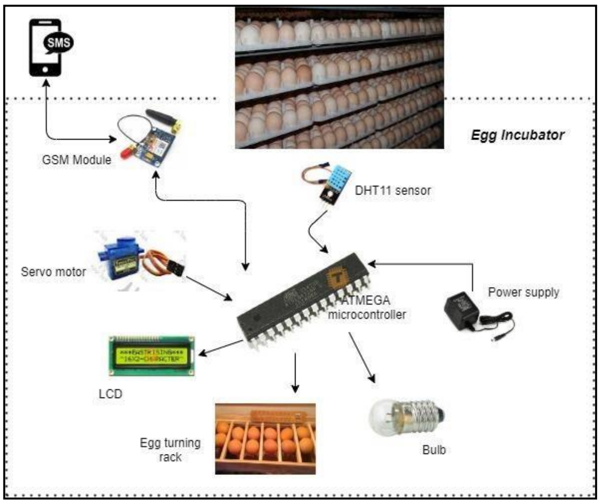


Fig 2: Conceptual Diagram for Egg incubation section

Atmega328p-PU Microcontroller/ Arduino Pro Mini Atmega328

Atmega328p is used as the processor (microcontroller) and it's directly connected with the GSM module and communicates sensor readings with the communication module to generate the output. All input/ output modules are connected along with the microcontrollers.

Temperature & humidity sensor module

Environmental conditions directly affect animal welfare, performances, and production. Therefore, temperature, humidity are the main parameters to be considered when designing the smart farm concept. The DHT11 sensor is used to provide the required accuracy for inhouse humidity and temperature present in the atmosphere.

Light sensor module

A digital light sensor (BH1750) is used to measure light intensity especially for naked eye light called "lux". The connectable voltage range is 3–5V and can accurately measure the LUX value of light from 1-65535lux. Also, the accuracy is +/- 20%. An inbuilt A/D converter is available to convert analogy illuminance into digital data. This sensor is commonly used in the mobile phone to adjust the screen brightness depending on the environment lighting.

Moisture sensor module

The connectable voltage range of the soil moisture sensor is similar to other sensors, and the inbuilt LEDs are used to indicate outputs and power. The LM393 comparator IC is used as a voltage comparator, and it will compare the threshold voltage using the pre-sets.

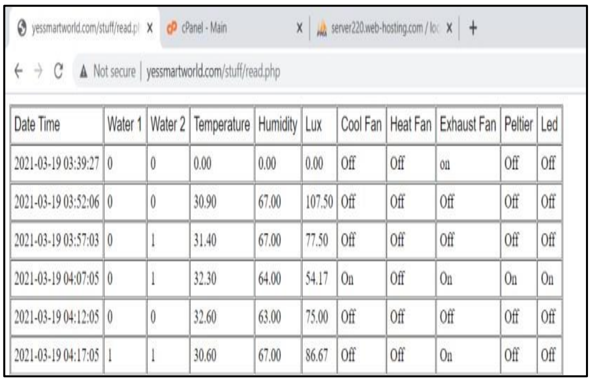
Communication module

The SIM800L GSM/ GPRS module is used as the communication component. It can accomplish all the tasks done by a cell phone like making and receiving phone calls, send SMS connecting to the internet. Here, the GSM module is used to send and receive SMS messages and GPRS data. All real-time sensor readings and threshold values are updated on the system, web page, and mobile application through the GSM module. Also, the SMS message is sent to the registered mobile number to notify all variations and retrieve data from the system. Thus, the GPRM modem is the heart of the monitoring and alerting system.

Interfaces (Web & Mobile application)

Interfaces are the core of the remote monitoring module. Interfaces are used for remote monitoring and controlling tasks. The mobile application is designed using "scratch" and the database of the web applications is programmed using SQL, PHP programming languages via Cpanel. Both web and mobile applications are interconnected along with the GSM module and microcontroller.

As shown fig 3 below, the web interface is designed for remote monitoring purpose. And the fig 4 shown the mobile application interface which is designed to achieve controlling and monitoring tasks. Thus, the farmer is able to monitor the latest status inside the farm simply via the mobile application. Also, the farmer is able to adjust the threshold levels of the defined parameters as per the bird age and the outer conditions. Also, the mobile application is facilitated to delete entire daily entries from the web interface.



yessmartworld.com/stuff/read.php

Date Time	Water 1	Water 2	Temperature	Humidity	Lux	Cool Fan	Heat Fan	Exhaust Fan	Peltier	Led
2021-03-19 03:39:27	0	0	0.00	0.00	0.00	Off	Off	on	Off	Off
2021-03-19 03:52:06	0	0	30.90	67.00	107.50	Off	Off	Off	Off	Off
2021-03-19 03:57:03	0	1	31.40	67.00	77.50	Off	Off	Off	Off	Off
2021-03-19 04:07:05	0	1	32.30	64.00	54.17	On	Off	On	On	On
2021-03-19 04:12:05	0	0	32.60	63.00	75.00	Off	Off	Off	Off	Off
2021-03-19 04:17:05	1	1	30.60	67.00	86.67	Off	Off	On	Off	Off

Fig 3: Web interface

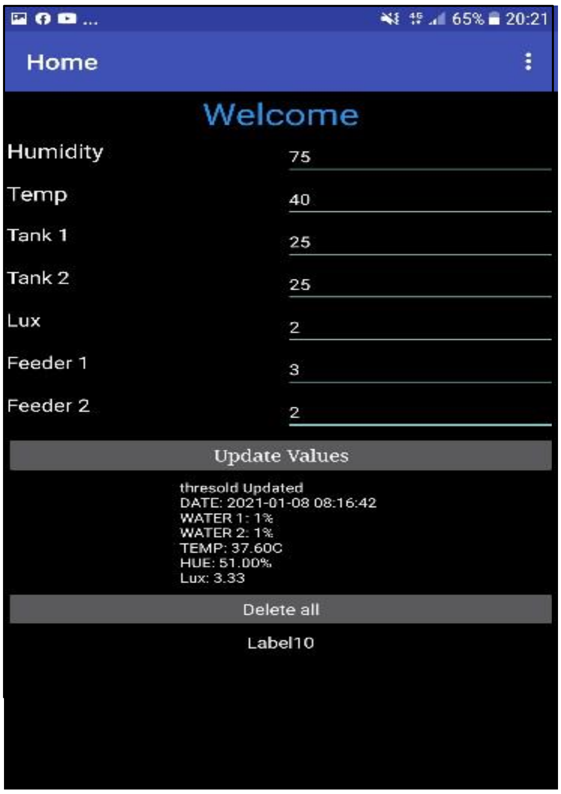


Fig 4: Interface of the mobile Application

B. System Designing

I. Block Diagrams

As shown in fig 5 and fig 6 the designed system is divided into control, alert module, and monitoring module. Both modules have consisted of four main parts; power supply, input components, output components, and communication module.

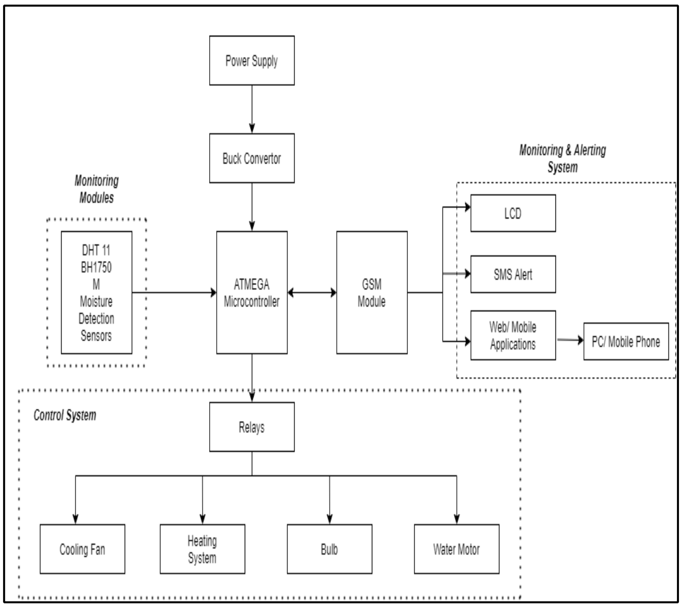


Fig 5: Detailed architecture for the Farming section

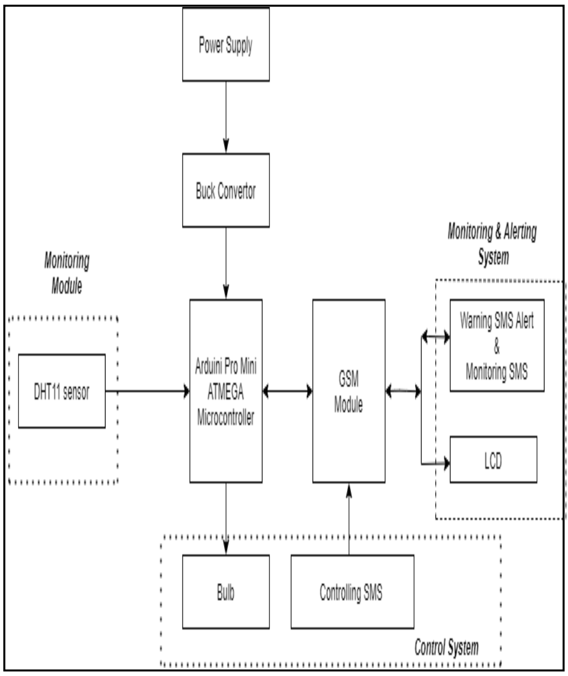


Fig 6: Detailed architecture for the
Egg incubator

The Atmega328p microcontroller is the core of the control and monitoring systems that are driven and measured by environmental parameters, watering process, and an incubator. As shown in fig 7 and 8, input components and the communication module are directly connected along with the microcontroller, and the output components are linked to the processor over relay module and transistors. DHT1, BH1750, moisture detection sensors are used to read and collect data in the chicken-coop. The supply voltage of 12V is regulated (step down up to 5V) through the voltage regulator (buck converter) and supply to the microcontroller, sensors, and the GSM module. The Peltier thermoelectric cooler kit is connected to the microcontroller through the relay module. And also, the cooling system, exhausting fan, light, and motors are connected to the microcontroller through the IRFZ44N transistors. Here the relay and transistors are acting as a switch as well as a shield to protect the microcontroller from high voltages. Since the input voltage is 240V and 12V is used by the controlling units. In the egg incubator, the DHT11 sensor, bulb, a servo motor is connected same as the farming section. The fig 7 and fig 8 shown the block diagrams for both areas

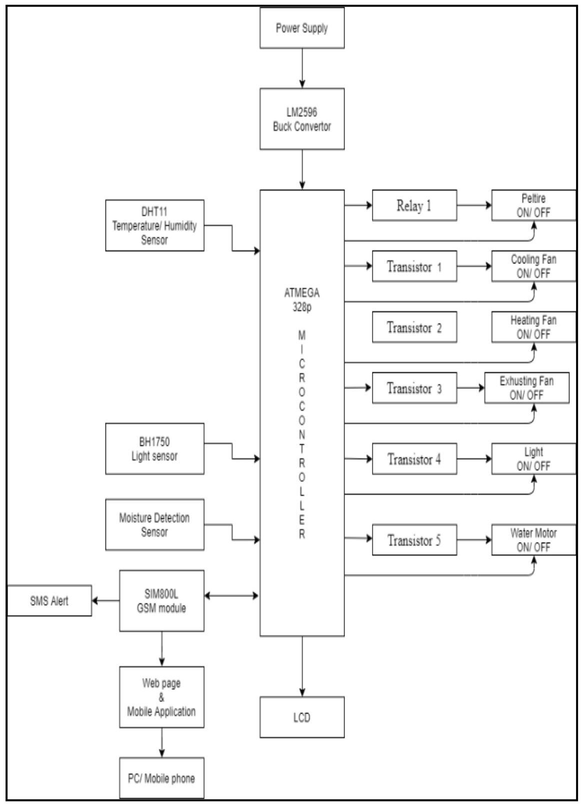


Fig 7 – Block diagram of the farming section

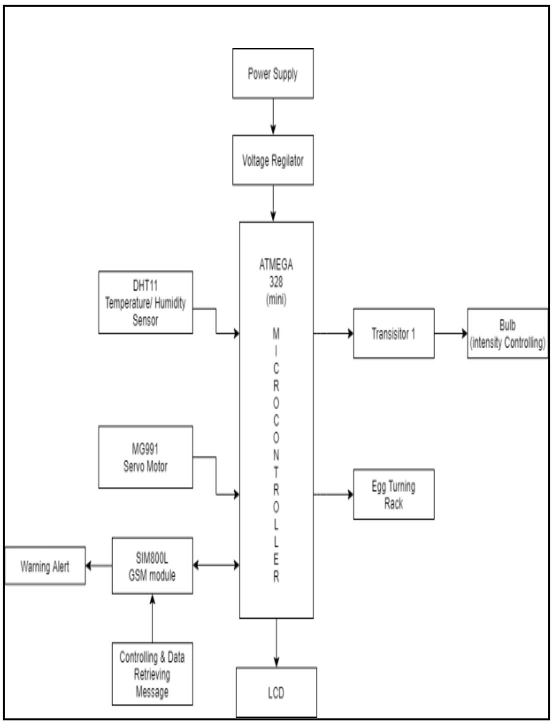


Fig 8 – Block diagram of the incubator

II. Flow Diagrams

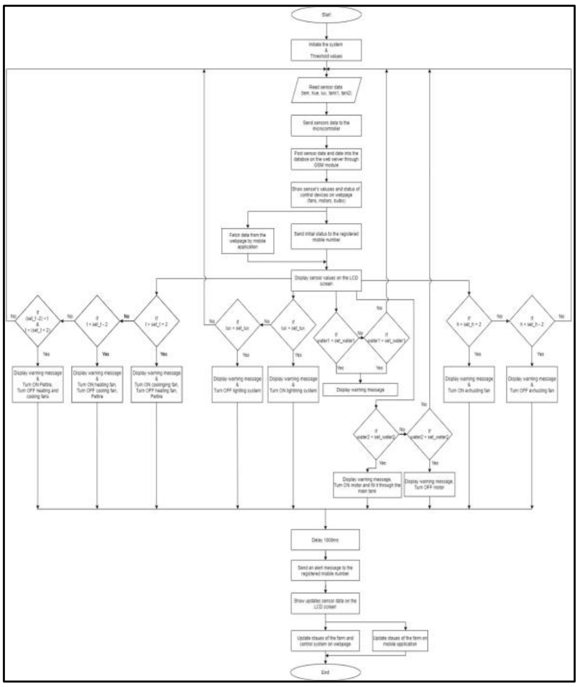


Fig 9: Flow diagram of device Operation

The operational flow chart for the farming section is shown in fig 9. The system is read environmental parameters of the poultry house, water levels, and egg incubation process using Atmega microcontroller and various sensors. The system is developed to check temperature, humidity, light intensity, and water levels to maintain the optimal conditions. The system is programmed to check sensor readings every 5 minutes since the high/ low water levels, temperature, and humidity variations can happen within the day. Also, the read data will be updated on the web interface and mobile application for every five minutes. The microcontroller will decide to switch the relevant relay and transistors to power up either the cooling fan or heating system to provide the required weather condition depending on the temperature readings. The humidity variations are controlled through the exhausting fan system. If the sensor detects a high humidity range, the exhausting fan is automatically activated through the microcontroller to maintain the optimal humidity range. The bulb is operated upon the light sensor readings, and the microcontroller will take necessary actions to manage the conditions respectively. When the sub-tank or the water container level goes below the threshold level, it will refill through the main tank by following the same process. If there are no variations in the sensor readings (not surpass the max & min threshold levels), the system will automatically recheck the sensor reading at the definite time. In the meantime, the communication module will be activated and send a warning message and a response message to verify the changes as well as taken actions by the system and current statuses. Furthermore, all sensor reading and current status of the poultry-house are displayed on the

LCD screen, website, and mobile application for remote monitoring.

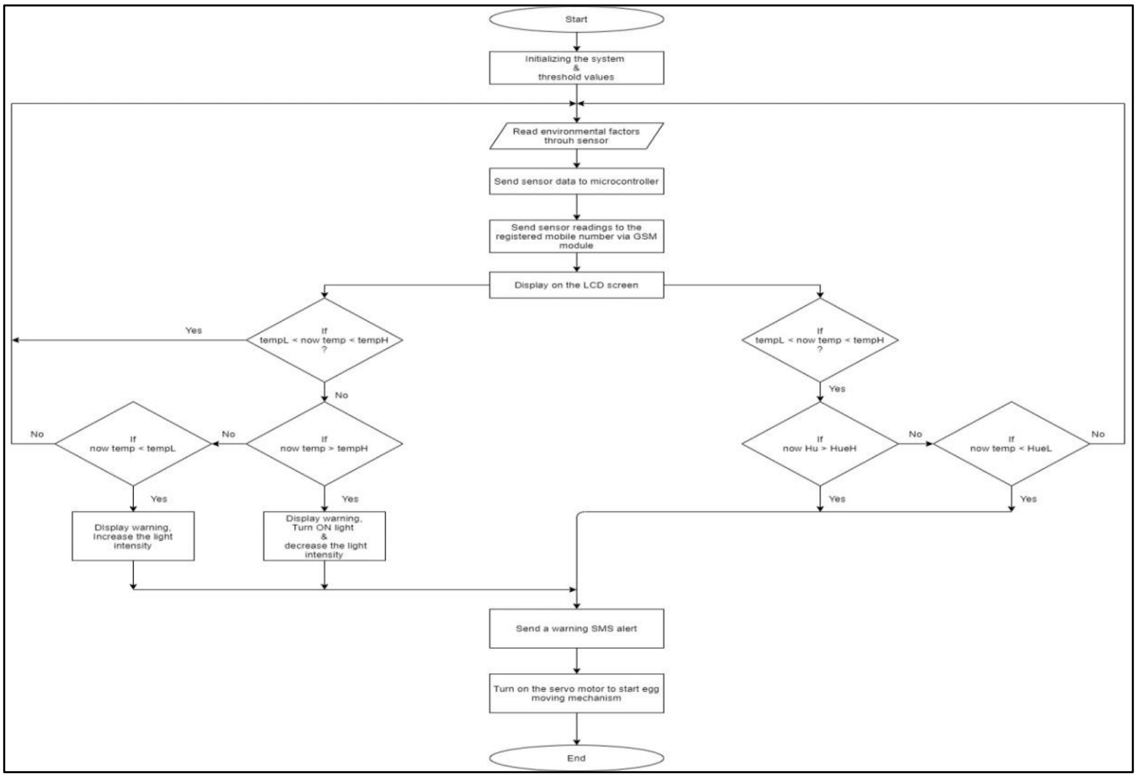


Fig 10: Flow chart of the egg Incubator operation

The fig 10 is shown the operational flow chart for the egg incubator. The DHT11 sensor is used in the egg incubator that monitors inside temperature and humidity levels. Here, the initial threshold range of temperature is programmed as 35°C-37.5°C. Firstly, the system checks the temperature is lower than 35°C or not. If it's lower than the threshold level, the microcontroller will automatically control the intensity of the bulb to maintain the required temperature range inside the incubator. If not, it will automatically re-check the temperature range, and when the sensor reading is fluctuating within the threshold range, the microcontroller keeps the light intensity as it is. The humidity is monitored by defining default humidity ranges into the system to achieve higher egg hatching rates than before. The alerting system is worked as a communication system that is used to monitor and control the incubator. When there are any variations in inside conditions, the system will send a warning message to the registered number. In the meantime, the microcontroller has been programmed to control a servo motor for moving the egg rack to increase hatchability.

C. System Implementation

The designed system is divided into two main modules; control, alert module, and remote monitoring module. The developed control, alerting module features the following major systems i) climate control system, ii) light control system iii) watering control system iv) incubator v) alerting system. The remote monitoring module is consisting of a web page and a user-friendly mobile application.

Alerting and Controlling

i. Climate Control System (temperature & humidity controlling system)

The DHT 11 sensor is used along with the microcontroller to read the accurate temperature and humidity reading inside the farm. To control the temperature of the hen house, as the normal temperature range for the adult birds is 34°C –38°C, such that the system arranges themselves the poultry-house temperature around that values. Thus, the climate control system is comprised of an exhausting fan, cooling fan, and heating fan systems.

If the temperature reading received from the sensor shows the value beyond the threshold range, the system will automatically trip the transistor to activate the system fan. When the temperature reading goes down below the maximum level, the sensor will automatically turn off the cooling fan system. If there is rainy or cold weather, the temperature reading will go below the defined level, and the processor will automatically turn ON the heating system, and it will turn OFF once the received sensor readings are within the threshold level. Meanwhile, the Peltier is set to turn ON when the detected temperature isn't within the default range. For better poultry management, the humidity is also controlled by defining default humidity ranges into the system, and the exhausting fans are working upon the sensor readings. The exhausting fan system is used to control humidity variations. The temperature and humidity levels and statuses are displayed on an LCD for physical monitoring purposes each second. In the meantime, the same data readings are updated simultaneously on the web page and the mobile application for remote monitoring.

ii. Light Control System

The BH1750 light sensor and incandescent bulbs are serially connected to the microcontroller. The light intensity is affecting the bird's growth, health, and performance. Such that, the farmers can easily control the light intensity via the designed system. The OFF status is the initial state of the light control system. Such that, all bulbs are switched OFF during the day time and switching ON during low light intensity (night or dark condition). Meanwhile, the microcontroller will send an alert message via the GSM module to the farmer by considering the light level. Also, the statuses will be updated on the web page, mobile application, and the LCD screen at the same time for internal monitoring.

iii. Watering System

Two moisture sensors are used to measure the water levels inside the main tank and the sub-tank. The sensor kits are directly connected to the processor, and the supply voltage is 5V. Further, the motor is connected to the microcontroller through the transistor, and the supply voltage is 12V.

Farmer is capable of setting the watering schedule using the mobile application. The automated system will help farmers to reduce the laborers count while increasing efficiency. The threshold tank levels are defined for both tanks, and the farmer is capable of setting the default watering time as he wished. If the water level is getting low in any tank, the warning message will be sent to the person-in-charge to notify the variation with the tank details. Then the farmer can adjust the default timing to fill up tanks.

iv. Incubator

The egg incubator is designed with temperature, humidity monitoring, and egg turning mechanism. It’s designed to monitor temperature, humidity variations to maintain a proper egg incubation rate in order to enhance productivity and food quality while reducing operating costs.

The egg incubator is designed using another Atmega328 mini microcontroller connected with DHT 11 sensor, servo motor (mg991), bulb, and GMS/ GPRS module. The inside temperature of the incubator is controlled by the microcontroller using a bulb. Furthermore, the light intensity is controlled to maintain the optimal temperature level inside the egg incubator. The egg rack is connected to the servo motor, and it is designed to move from left to right to achieve proper hatchability, food safety, efficiency while reducing the labor count and wastages. Thus, the rotation of the egg rack is controlled by the microcontroller and the servo motor. Further, the rack is moved left/ right sides every 5 minutes through the motor with a 12V power supply. The processor will send an alert message through the GSM module to the person-in charge if the temperature or humidity levels are below the pre-set value and automatically adjust the inside temperature. Furthermore, the processor has controlled the intensity of the bulb when the temperature isn’t within the threshold ranges (3537.5°C) that is necessary for a better hatching rate. The sensor readings are displayed on the LCD screen for monitoring purposes. And also, the system will automatically generate an SMS message when the sensor detected any humidity changes (40-60%). The owner can change the defended temperature, humidity ranges via a text message. In addition, the farmer can retrieve the current status inside the incubator by sending a message request to the system, and it will send the latest updates.

v. Alerting System

This system is comprised of a SIM800L GMS/ GPRS module directly connected to the Atmega microcontroller that sends warning alerts to the registered mobile number when there is variation in any parameter inside the farm and egg incubator. For example, if the moisture sensor reads a value below the threshold level, the system will send a detailed warning message to the person-in-charge to notify the variation. After receiving the message, the farmer will be notified about the changes of the water levels, and he can set time to activate to motor to fill-up the water levels. Furthermore, the alerting module is sent a response message after the relevant tank is filled to the required level. The same process will be following for other parameters.

Additionally, the farmer can send a request message to manipulate and update the status, threshold values. Also, this facility is applicable for the egg incubator. The system is worked based on the assigned keywords (keywords), and also, the farmer is able to send this message through any phone number. For example, in the incubator, remote monitoring is achieved by the text messages which is sent and received through the GSM module. The farmer can send a request message including the “read” keyword to retrieve the current status of the incubator.

Results and Discussion

When the system is initializing, the threshold values and initial sensor readings are sent to the web interface and it is displayed on the LCD screen. It will be updated on the web page after 10-20s. Also, the mobile application will be gathered the relevant data from the webpage and update on the mobile application with the date and time. Also, the SMS is sent to the registered mobile number based on the initial conditions inside the farm and egg incubator. It is shown in fig 11.

Fig 11: Displayed notifications during the initializing process

If the inside temperature, humidity, light intensity, or the watering levels are below or beyond the defined threshold level, the designed system will be automatically turned ON/ OFF the relevant controlling unit based on the sensor readings. For example, as per the fig 12, the temperature, humidity thresholds are defined as 25°C-28°C, 50%. As per the figure, read sensor data is 31°C and 74%. Thus, the cooling fan and the exhausting fans are automatically turned ON to control the unnecessary climate changes inside the poultry-house. As per the fig 13, the system is managed to send an alert to the registered mobile number and the status will be update don the web interface within 5 minutes. Such that the same process is followed by the other systems to control high/ low parameter changes.

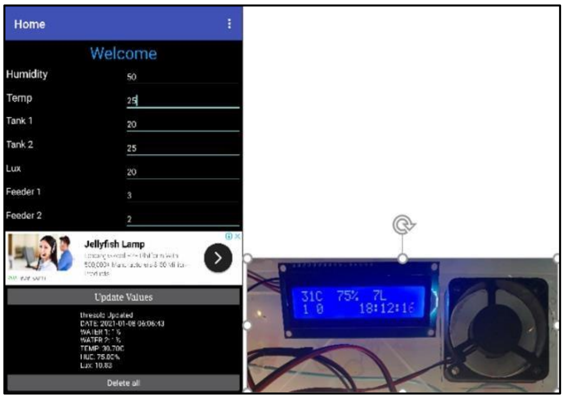


Fig 12 :Defined threshold levels and sensor readings

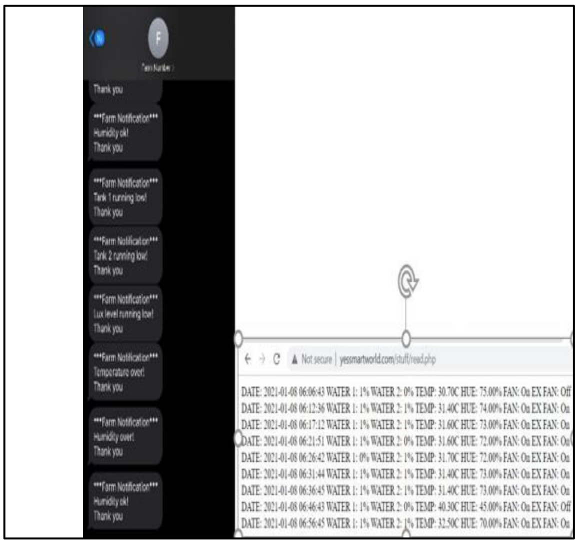


Fig 13: Sent warning message and the updated status

Another data entering and data retrieving method is introduced to the egg incubator. Thus, the farmer can be updated default temperature and humidity ranges via a SMS using the relevant keywords and symbol. This helps to adjust the required parameters based on the age of eggs, growth, and egg conditions. And the defined threshold levels will be displayed on the LCD screen simultaneously. Therefore, owner can be able to set up the system very easily through any mobile number. The fig 14 shown the SMS method which is used to defined threshold parameters and the fig 15 shown the data retrieving process. *(Note: received data and latest update may be varying with testing time.)*

Operating key words

- Temperature:“thigh<temp>#”&
- “tlow<temp>#”
- Humidity:“hhigh<humi>#”& “hlow<humi>#” Data retrieving: “read”

Fig 14: Defined threshold values via a SMS and display method

Fig 15: Data retrieving method

The light intensity inside the incubator is controlled based on the sensor readings and the defined threshold values. As per the fig 16, if the temperature level is higher than the threshold level, the light intensity will be automatically reduced to maintain the approximate temperature. Also, the light intensity will be increased once the temperature is within the defined threshold range. Further, the bulb is turned off when the temperature reading goes beyond the defined maximum level and the alerting messaged will be sent to the registered mobile number. Also, the egg rack is designed to hold six eggs at a time and the egg rack is implemented to move from left to right and right to left for every five minutes (fig 17). All updated will be sent to the registered mobile number for monitoring purposes. It shown by the fig 18.

Fig 16: Temperature controlling Mechanism inside the incubator

Fig 18: Received status of the Environmental parameters and egg rack

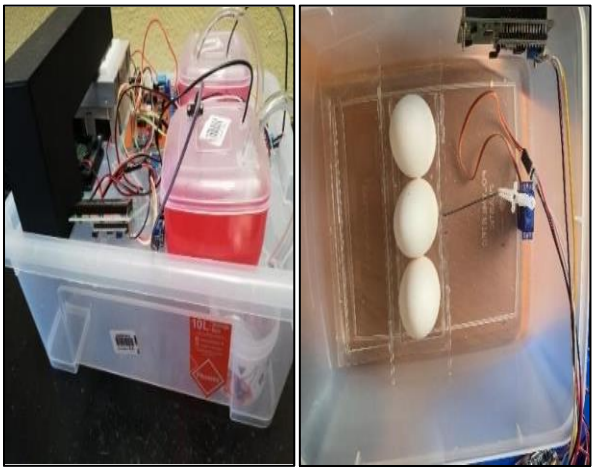


Fig 17: Prototype farming section and Egg rack

Initial threshold levels and defined actions

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	Parameters	**Threshold range**	**Action Perform**	**Send Warning SMS**
Farm Section	Temperature	34-38°C	t > t_max - cooling fan t < t_min - heating fan t < t_max & t > t_min - Peltier	
	Humidity	78% - 82%	h > h_max - exhusting fan h < h_min - heating fan OFF	
	Light intensity	10lux	lux < set_lux - light ON lux > set_lux - light OFF	
	Water level - T1	50%	t1 < w_set -motor ON	
	Water level - T2	60%	t2 < w_set -motor ON	
Egg Incubator	Temperature	35-37.5°C	t > t_max - Light off	
	Humidity	40% - 60%	send SMS	

Table 1: Initially defined threshold levels and actioned to be taken based on the sensor readings

Discussion and Conclusion

The project is aimed to increase efficiency, poultry productivity, and profitability among less labor intervention. Further, the project aimed to reduce the operating costs, wastages while reducing manpower utilization. Besides, the farmers can increase the production rates by providing the optimal environmental conditions inside the poultry-house an incubator to increase animal welfare. As a result, farmer able to increase the profitability. The designed system provides remote monitoring and controlling besides physical monitoring for both poultry-house and egg incubator. Since real-time monitoring of environmental parameters is crucial in poultry and agricultural industries. Such that, the system is monitored significant changes in inside environmental parameters real-time monitoring of environmental parameters is crucial in poultry and agricultural industries.

The system ensures effective egg incubation and hatchability without causing internal issues and damages (at the approximate condition). The developed egg moving mechanism will help to measure the efficiency and quality of the eggs than the manual process. Furthermore, farmers can check the current status by directly sending a message to the incubator. Thus, farmers can connect and check the current status and take quick action to minimize the bad effects, if there are unnecessary changes inside the farm. Further, the farmer can aware of the changes inside the poultry-house and incubator using the alerting system. Hence, farmers can supply quality, fresh, notorious poultry production to gain market shares and profitability. Thus, the farmer can maximize the production rates, profitability, and efficiency with less human interface and operating costs. Also, animal welfare will be enhanced as an indirect result of automation.

As future working, the mobile application may be re-developed to operate fans, lights, and motors without any hesitation. Also, it is planning to be modified to operate in both android and IOS operating systems. Further, most birds are usually suffering from bird flu which is identified by various surveys. Bird flu is a serious case that affects animal welfare and performance. And also, it will be affecting their metabolism and slow down the growth. Hence this will be harmful to the health of farmers as well as workers and neighbors. Thus, a health condition detection system can be implemented for early detection of bird flu and other health issues. As analyzed, it can be achieved by RFID and AI technologies as future work

Declarations

Study Limitations

The developed system was proposed to implement and test at an actual small-scale poultry house to check the accuracy and effectiveness. Unfortunately, it is unable to achieve as wished due to the current pandemic situation in the country. Thus, it's developed as a prototype system to give the conceptual idea of the proposed concept. Also, the developed mobile application is allowed to use in an android platform. Hence the above-highlighted limitations are figured out as the limitations of the artifact.

Acknowledgements

The author would like to express sincere gratitude to the project supervisor Mr. Nimesh Pollwaththage, and the reader/ module leader Mr. Tilak De Silva for the supervision and guidance given for this project. Also, the author would like to thank the department of IT of CINEC campus and the University of Wolverhampton UK for providing a chance to complete a successful individual project and a study within the given time frame.

Funding source if any

Provide funding source, supporting grants with grant number. The name of funding agencies should be written in full. If no funding source exist, please write none. **Conflict of Interests**

Declare any potential conflict of interest exist in this publication.

Human and Animal Related Study

If the work involves the use of human/animal subjects, each manuscript should contain the following subheadings under the declarations section- **Ethical Approval**

Provide ethical approval authority with name with the reference number. If ethical approval is not required.

Informed Consent

Write a statement of informed consent taken from the participants to publish this research work. The editor may ask to upload scan copy if required.

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