SOUTHEAST ASIAN JOURNAL OF SCIENCE AND TECHNOLOGY

Volume 4, Issue 1, 2019
P-ISSN: 2672-2984
E-ISSN: 2672-2992
www.sajst.org

Arduino-Based Monitoring Device for Day-Old Chicks

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Abstract *–In poultry farm, maintaining the temperature inside the cage is crucial activity that should be given intensive attention by the caretakers and owners. Temperature affects the broiler's selling weight and health thus increases the operating cost which burdens the owner financially. As far as the reading of the researchers is concerned, there has not been a published research and developed device in the South East Asian countries with the same concept. This study aimed to develop a device that automatically notifies the poultry caretaker if the temperature inside the cage goes down and switches off the light/s when certain temperature is met. The device is comprised of temperature and humidity sensor and modules such as Global System for Mobile communication (GSM), Real-Time Clock (RTC) and Light Crystal Display (LCD). The sensor detects the temperature inside the cage and will evaluate the gathered data using different parameters to automatically switch on/off the lights. If the device detects the desired temperature, it will automatically switch on/off the lights and send a notification message to the poultry caretaker via SMS using GSM module. This study followed the agile methodology with ISO 9126 - based questionnaire and interview as a mode to gather data. For future works, evaluation for the level of acceptability in terms of functionality, usability, efficiency, maintainability and portability is highly recommended. Furthermore, improvement of the system based on the evaluation comments can be explored by other researchers.*

Keywords *– GSM Module, Arduino Microcontroller, ISO 9126, Temperature, Temperature sensors.*

INTRODUCTION

Having an exact temperature to layered chicks are very important to help them to grow healthy. Temperature is one of the major problems by the owner of the poultry farm. Maintaining the correct temperature is critical in broiler chicks, especially during the first two weeks of the chick's life. If the room temperature decreases the chick's body temperature decreases, if the room temperature increases the chick's body temperature will increase. Chilling or overheating during this crucial period can result in poor growth (Fairchild, 2012).

Properly maintained temperatures of produce inhibits pathogen growth and reduces the risk of spoilage. In an industry where efficiency and profit margins are constantly scrutinized, it is important to ensure the quality of your product (Gong, Anderson, Rathgeber, &MacIsaac, 2016).

In the Philippines, the climate in poultry buildings affects both human well-being and health of birds. Climate can be defined as the sum of factors affecting the functioning of humans and animals. House climate can be influenced by insulation of roof, walls and floor, ventilation, heating, cooling and lighting. The climate directly surrounding the birds is called the microclimate (for example, chickens in a brooding ring). The birds' body temperature is between 41°C and 42.2°C on average. The comfort zone is described as the temperature area where the birds can maintain a steady body temperature with minimal effort. When temperature is rise above the comfort zone as they begin to pant and alter their body position, bird behaviour will alter (poultryhub.org, 2018).

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OBJECTIVES OF THE STUDY

The study aimed to design and develop an Arduino-based monitoring device for day-old Chicks to measure the temperature of the light that comes to the layered chicks. The device automatically notifies the poultry caretaker if the temperature inside the cage goes down and switches off the light/s when certain temperature is met. Moreover, it also assessed the level of acceptability of the developed device as to Functionality; Usability; Efficiency; Maintainability; and Portability.

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MATERIALS AND METHODS

In the development of the device, this study used the Arduino Integrated Development Environment (IDE) with version of 1.8.5 and C++ as a programming language. In the development of the device, this study used an Arduino Mega Board, temperature sensor, LCD I2C, BULB, Relay and Global System for Mobile Communication (GSM) Module.

The pilot area for this study was in the Bolong Farm, Almeida, Balaoan, La Union. A total of 17 respondents comprised of owner, supervisor and caretakers of the poultry. Interview and questionnaire based on ISO 9126 are the main tools in gathering data. This study also followed the different phases of Agile Modelling. The researchers undergone its different phases.

Phase I. Requirements. The researchers conducted a series of interviews to the Owner, Supervisor and the caretakers in Bolong Farm to collect the necessary information and requirements needed in designing and developing the device. For the device that will be develop, the researcher used the Arduino technology as the main controller for the device with the help of sensing devices and modules like temperature and humidity, LCD, GSM, RTC and Relay.

Phase II. Design & Architecture. The researchers discussed the detailed identification of the device to construct and perform necessary tasks such as detecting temperature. The researchers also prepared a general design requirement for the device and the creation of the use-case diagram that will serve as a guide on how the device will performed by the end-user.

Phase III. Development & Coding. The researchers designed and developed the device. For the hardware, the researchers used the Arduino technology as the main board to construct the Arduino-Based Monitoring Device for Day-Old Chicks with different sensing devices like temperature along with the GSM module. For the software, the researchers used the *C++* programming language and Arduino IDE.

Phase IV. Quality Assurance & Software Testing. The researchers conducted a series of tests to assure that the developed device will be useful to the endusers. Housing of the device were also be done in this phase to serve as cover and protection of the device.

To evaluate the level of acceptability of the device, the researchers used a questionnaire as the main instrument or tool in gathering the based from the ISO 9126 by Abran, (2003) used by Bee Bee Chua et. al., (2004). A set of questionnaires are given to the owner, supervisor and caretaker of the Bolong farm. Comments or suggestions were analyzed and if possible, included in the device.

Phase V. Implementation. In this phase, the researchers have deployed the developed device to the end-user.

Phase VI. Maintenance & Support. In this phase, the researchers trained and gave support to the end user on how to use the developed device. User documentation and user manual were also be generated on how the device will be operated and maintained.

RESULTS AND DISCUSSION

The prototype of this paper is shown in fig. 1 as displayed in figure there are 7 parts that used such as 1) GSM Module 2) Arduino Board Uno 3) RTC (Real Time Clock) Module 4) DHT Sensor 5) Incandescent Bulb 6) LCD (Liquid Crystal Display) i2C 7) Relay comprised of Arduino microcontroller, temperature sensor and modules such as Global System for Mobile communication (GSM), RealTime Clock (RTC), Light Crystal Display (LCD) I2C and Relay. The Sensor (part 4) are responsible for sensing the temperature and it will trigger the relay (part 7) to automatically turn on if the temperature doesn't enough and turn off if the cage temperature met the required temperature of chicken's body. The Real Time Clock (part 3) is responsible for giving the device an exact time and date and display it on the LCD i2c (part 6) also the temperature that the sensor detects. The GSM module (part 1) is used to send a SMS notification to inform the caretaker if the bulb is on or off. The concept of the study is shown

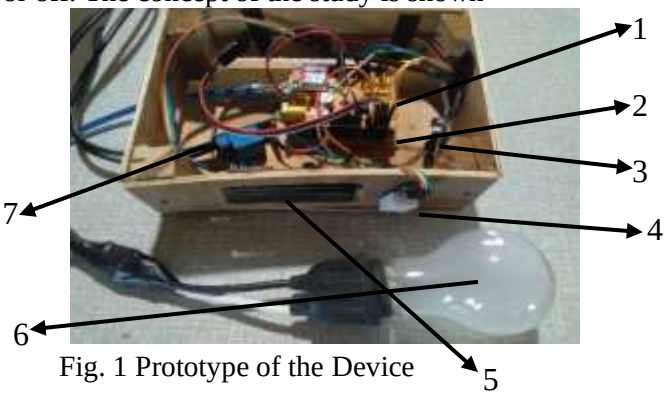

Fig. 1 Prototype of the Device

The summary of evaluation of the respondents is shown in table 2. As perceived in the table, the respondents evaluated the device as acceptable in all categories with its Usability as rated highest. This result

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indicates that the developed device is usable for them for the growth and production of their chicks. The result of this study strengthens that more control of the variability of the classical physical conditions are required in order to improve hatchability and chick quality (Decuypere, Tona, Bruggeman, Bamelis, 2001).

Table 2. Evaluation Summary of the Respondents

Item	Mean	Descriptive Rating
Functionality	4.33	Acceptable
Usability	4.59	Acceptable
Efficiency	3.95	Acceptable
Maintainability	3.80	Acceptable
Portability	4.57	Acceptable

CONCLUSION AND RECOMMENDATIONS

Results above show that the device is acceptable and can help the management and caretakers in their poultry farm. This means that the device can increased the chick's growth, development and production, and decrease diseases and death.

Future works can include the improvement of the device by incorporating the recommendations of the respondents. Implementation of the device in a national scenario is also highly recommended.

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