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Development of Chicken Egg Incubator Prototype with Blynk Notification

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Abstract: The development of a chicken egg incubator prototype with Blynk application notification is to assist farmers in monitoring the hatching process with notifications to users. This research presents the design and development of a chicken egg incubator. The aim is to test the functionality of this system designed to monitor and control the temperature of chicken eggs in the incubator using the Blynk application. The methodology used to develop this prototype is an adaptation of the prototype model which has 5 phases which are the phase of requirements analysis, initial design, building the prototype, evaluation, and maintenance. In this design, researchers use a temperature control system that controls the temperature of the incubator. The system consists of temperature sensors, heating and cooling elements, and controllers. If the temperature of the incubator exceeds a certain value, the cooling unit will operate to reduce the temperature while if the temperature is below another value, the heating element will start to operate to increase the temperature. Furthermore, the researchers used a motion sensor to detect the movement of the eggs. If there is movement inside the incubator, the owner of the incubator will get a notification about the status of the egg on the user's phone. This writing, it is more about recommendations, procedures, and expected results from the construction of this project.

Keywords: Egg Incubator, Blynk Application, Prototype, Notification

1. Introduction

An incubator is a tool that can be maintained to control the warmth of chicken eggs during the incubation process (Sivamani et al., 2018). To get quicker outcomes, this incubator was designed to mimic the natural incubation process of the mother hen and her eggs. If the temperature is consistently supplied at the right setting, the incubator performs well. Typically, these prototype incubators are only made in tiny sizes and are constructed by breeders for their personal usage. Monitoring using technology is easier to handle by the user himself (Purwanti et al., 2021).

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To hatch chicken eggs, a hatchery is used. The developing embryo inside the egg can develop and hatch without the mother hen's presence because the incubator keeps the eggs warm. In the absence of human assistance, it aids breeders in the automatic hatching of eggs (Prinyakpt & Roongprasert, 2019). Additionally, egg incubators not only dramatically boost chicken production but also produce respectable revenue, enabling farmers to become self-sufficient and turn to rural entrepreneurs. Due to evaporation from the egg itself, the eggs often get lighter and have a larger air space throughout incubation (Azahar, Sekudan, & Azhar, 2020). Every study that is undertaken employs a unique set of techniques. Incubator operating systems vary in their level of expertise as well. There are studies that use Arduino to operate incubators, but reading revealed that this technology is only used to read the temperature and humidity values from the sensor and display them on a Liquid Crystal Display (LCD), as the researcher uses two digital temperature controllers, one of which is the W1209 (Redzwan, Enzai, & Zin, 2018). The heating element, which is the bulb, is the first thing the temperature controller W1209 controls. The bulb will be turned on by a temperature controller until the temperature reaches the predetermined temperature, which must be higher than 37°C, at which point the bulb will automatically turn off (Uzodinma, 2020).

This study will be used the combination with current technologies to enhance the incubator system now available on the market and showcase it to the cattle business. As a result, the system that will be developed will combine concepts from other ongoing projects to monitor and regulate the temperature within the incubator using IoT. Table 1 contains a list of previous research that can be used as a model for this project's innovation. It is vital to conduct research on present-day items to compare their qualities to those of the products that will be made in this project. The key purpose of this existing product analysis is to ensure that the product has more features or other advantages than the current one so that the existing product can be upgraded.

As a result, this kind of incubator was created to shorten the egg incubation process so that breeders could enhance their outcomes and profits. The created mechanism has benefits for both the breeder and the chicken eggs. Due to the control that has been established, this technique enables the chicks that are placed in an incubator to acquire a more stable temperature environment. This technique is useful for all chicken breeders since it allows them to keep an eye on the condition of the chicken eggs in the incubator even when they are located far from the farming area.

Table 1: Comparison of existing products

No.	Product Name	Product picture	Product Description	Deficiencies product
1.	Prototype incubator	 (Sutanto et. al., 2021)	- Built using a plastic container, a light switch, a 100W light bulb, and some adhesive tape. - Recycled frozen food plastic boxes and some sponges are used to create humidity in the incubator. - Dual thermometers and humidity meters are placed in the incubator to monitor the ambient temperature.	- No temperature control like a fan - No IoT system
2.	Market incubator	 (Ate, 2021)	- Using plastic containers - Incubators that are built more sophisticated. - Has an LCD display	- The selling price is too expensive ie RM 700 and above for one incubator. - No IoT system

2. Methodology

The methodology for the egg incubator prototype is an adaptation of the Prototype model, which contains five basic processes that must be completed: requirements analysis, initial design, prototype construction, assessment, and maintenance.

2.1 Phase 1: Requirements Analysis

As part of the requirement analysis approach, the researcher performed a preliminary study of the breeders during the requirement analysis phase. Breeders are questioned during the process of learning about their challenges and the need for a new system. According to preliminary findings, breeders need a system that can monitor the incubator and manage the temperature remotely. Table 2 shows the summary of structured interviews with breeders.

Table 2: Summary of structured Interviews with breeders

Question	Answer (Breeders)
What are the challenging things in the process of hatching chicken eggs?	Temperature control to ensure the chicken eggs get the right temperature
What aspects need to be taken care of to ensure successful hatching?	The most important aspect of temperature control to ensure successful hatching goes well
What is the ideal temperature for chicks?	The appropriate heat temperature is 35℃- 37℃
How many eggs can a mother hen incubate at one time?	Only in 5 to 8 eggs only
What is the method of monitoring chicken eggs when they are being incubated?	Manually, that is by monitoring twice a day
Have the chicks ever died during the hatching process? Why?	Yes, because the surrounding temperature is not suitable for chicken eggs.

2.2 Phase 2: Initial design

The second stage is quick or preliminary design. At this stage, the system's basic design is created as shown in Figure 1. It is not, however, a finished design. It gives the user a summary of the system concept. Prototype development is made easier by rapid design. The system will be modified into a prototype system at a lower scale based on the designed system. The complete system will therefore be set up on a simulation board that is shaped like a whiteboard. The chosen design was determined by the incubator's original state.

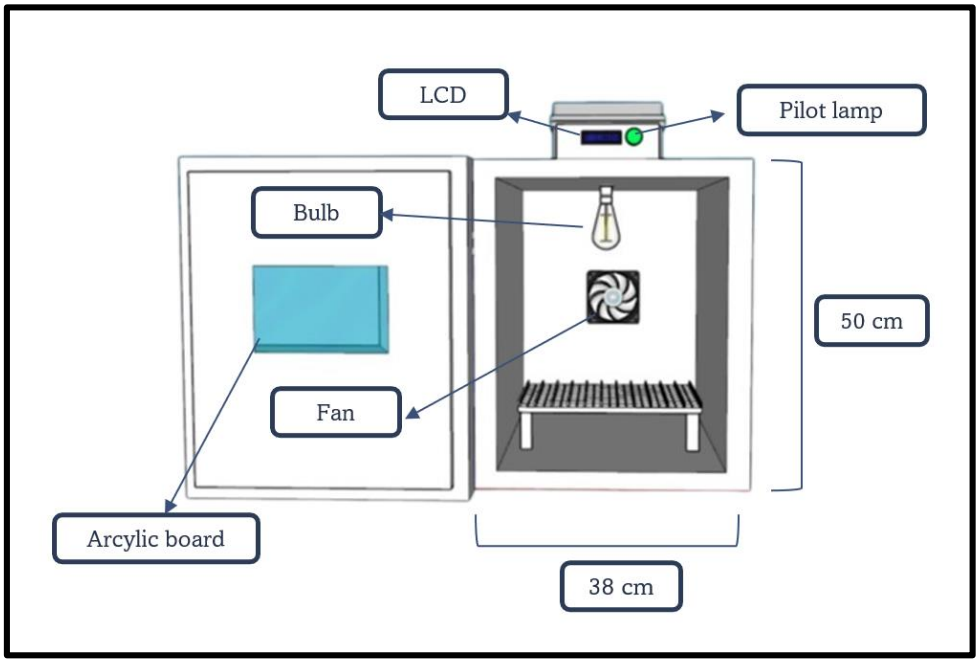


Figure 1: Prototype Front view

A flowchart is a diagram that shows the procedures that must be followed to solve the issues at hand. The flowchart for the prototype egg incubator is shown in Figure 2. Figure 3 is particularly useful while developing a product since it demonstrates how the hardware and cable are connected to one another. In a schematic diagram, visual symbols are used to represent the electrical connections and

functions of a certain circuit design. Without considering the physical size, form, or location of the component devices or pieces, the schematic design is used to trace the circuit and its functions.

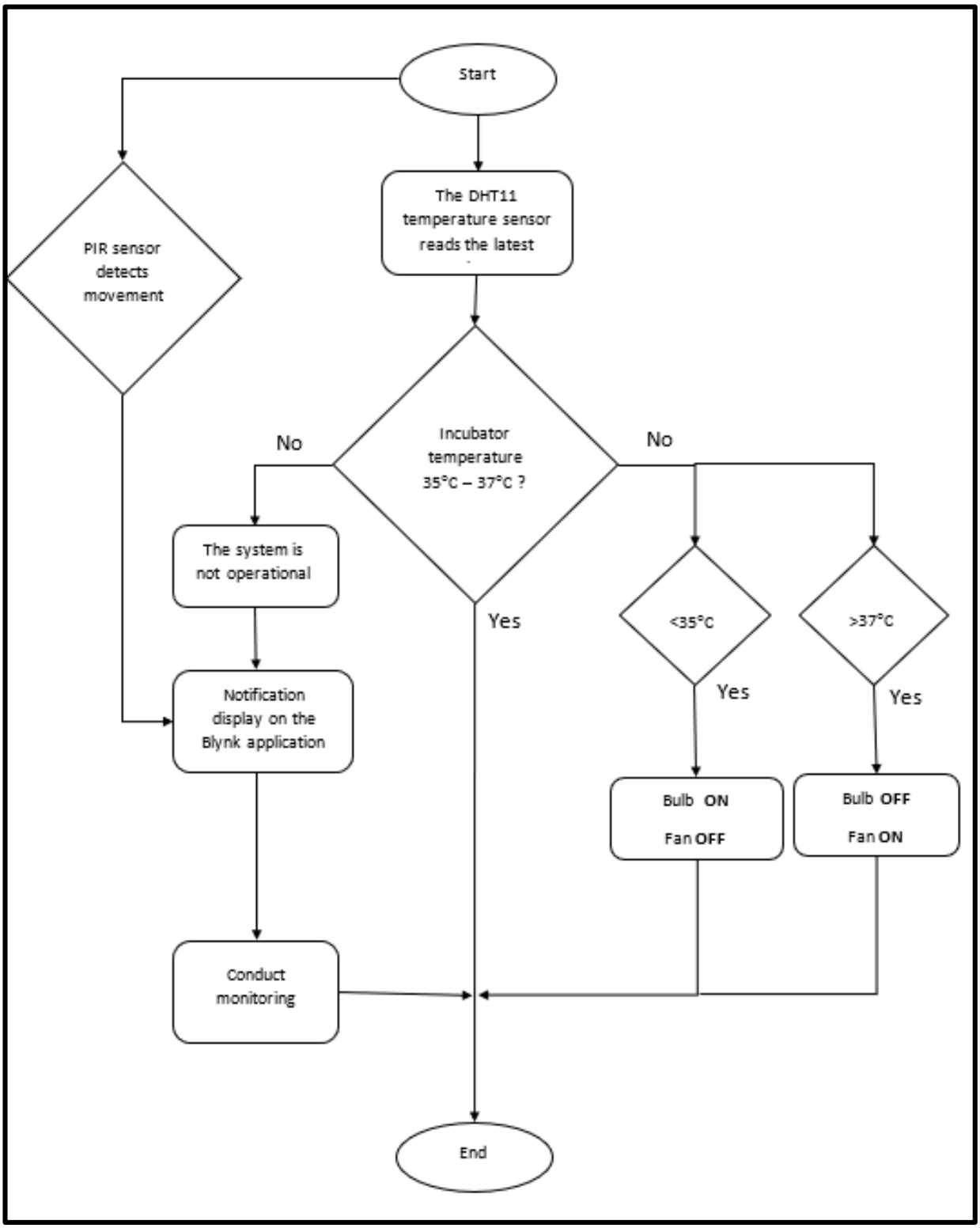


Figure 2: Flowchart of Process

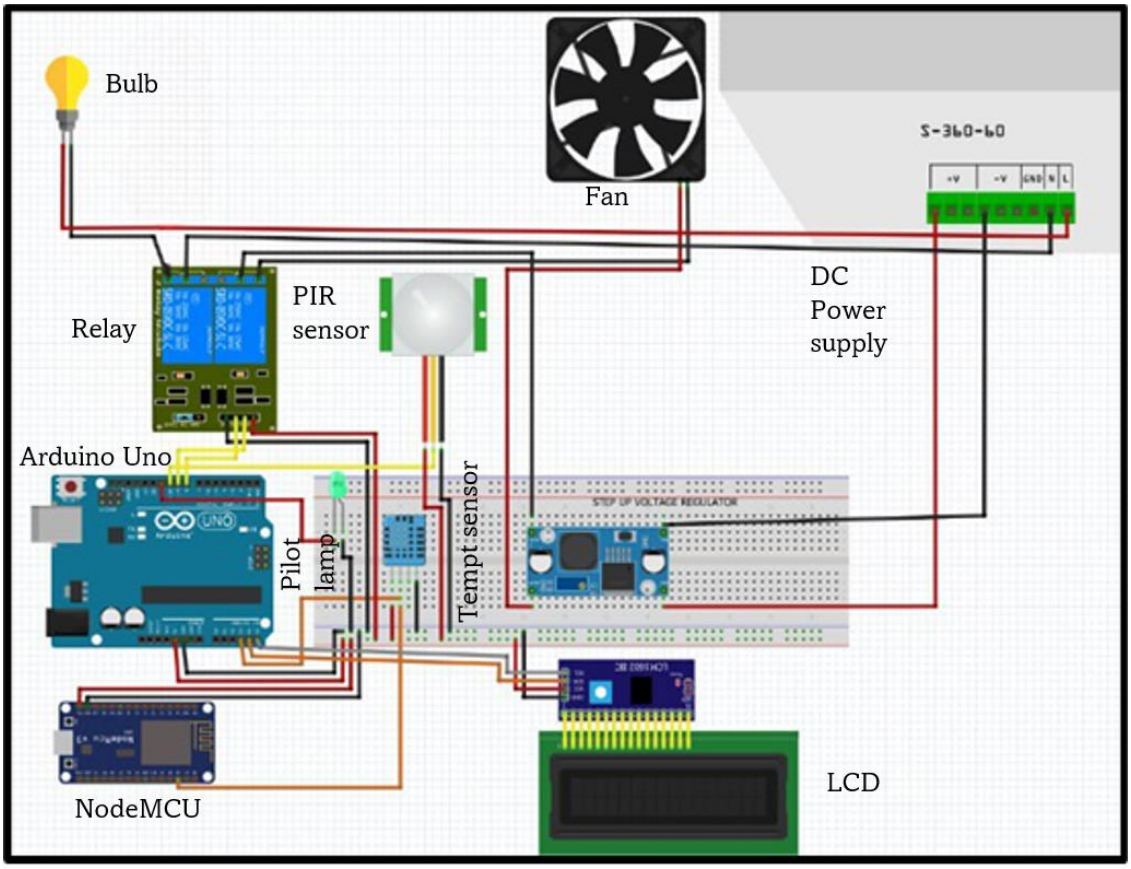


Figure 3: Schematic Diagram of the Egg Incubator

2.3 Phase 3: Prototype Development

Based on the data acquired from the preliminary design, the actual prototype is designed in this stage. It is a scaled-down version of the necessary system. Because system development will begin at this phase, development is a crucial phase. The hardware and software needed to construct the chicken egg incubator with the Blynk application notification, Arduino for the microcontroller, and the Blynk application for notification as well as the database, are the two primary components of this phase. The system's operations are contained in the microcontroller. displays the outcomes of a chicken egg incubator prototype development with Blynk application notification, coupled with a description of the properties of the materials used to construct the prototype. The outcomes displayed are based on the original sketches created during the planning phase.

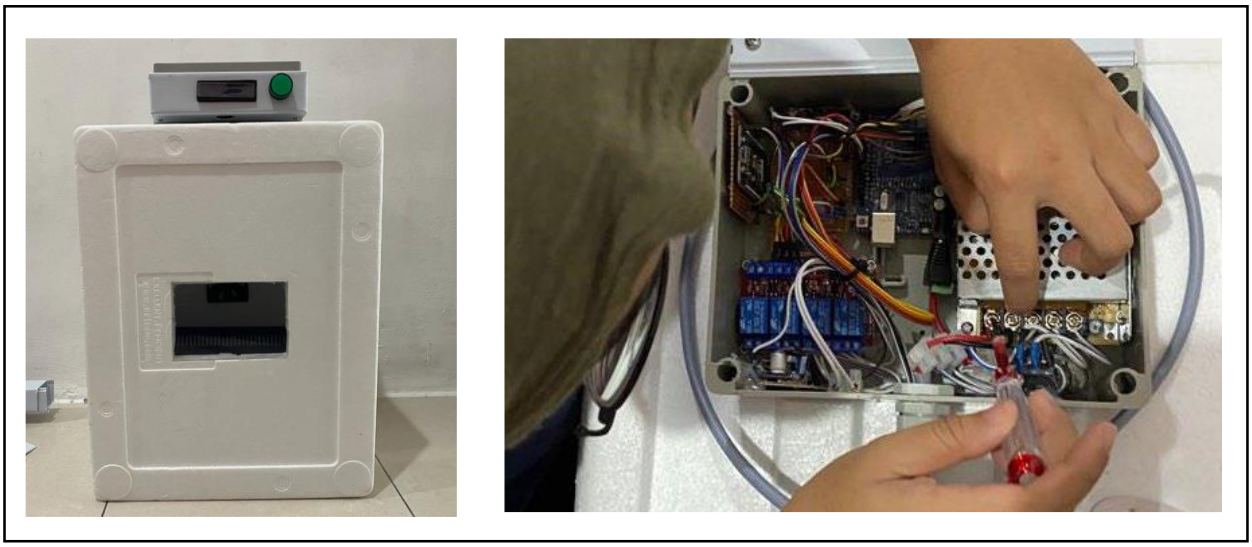


Figure 4: Process of Constructing Hardware

2.4 Phase 4: Testing and evaluation

The prototype of the developed design will be tested by the researcher during this testing phase because it is crucial to do so to evaluate the system's functionality. To ensure that the product will function as it should, testing and assessment are done. The researcher will move to the maintenance phase, which is the opposite phase if there is a problem. Prototype testing generally enables reviewers and customers to determine whether a design is appropriate for commercialization. Comments and advice will be recorded for future improvement. The most crucial testing phase, this one establishes whether the intended system can accomplish the goal.

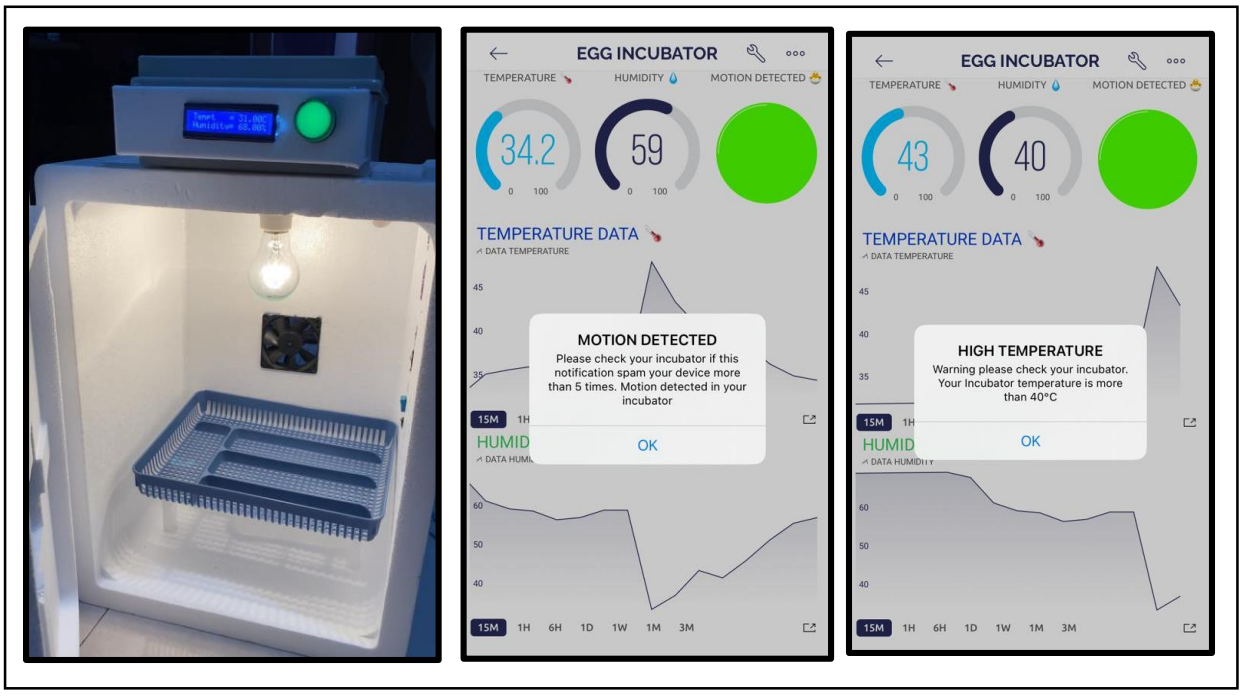


Figure 5: Testing the Incubator System

2.5 Phase 5: Maintenance

The product implementation and maintenance phase involve making changes to hardware, software, and documentation to support its operational effectiveness. It includes making changes to improve system performance, fix problems, improve security, or address user needs. Once the final system is developed based on the final prototype, it is tested carefully and used for production. The system undergoes routine maintenance to minimize damage and failure of the project to function.

3. Results and Discussion

The results section presents the data from the study.

3.1 Result of the sensor reading

The results as shown in Table 3 are an analysis of the functionality of the temperature sensor along with the fan and bulb. As the following analysis shows this component can be used well where when the temperature is less than 35°C, the bulb will remain alive until the temperature in the incubator becomes 37°C. When the temperature has reached 37°C then the bulb will turn off and the fan will turn on automatically. At a temperature of 37°C the fan will work to control the temperature in the incubator such as the required temperature range which is 35°C to 37°C only.

Table 3: Analysis of The Functionality of The Temperature Sensor

Temperature	Bulb	Fan
Less than 35°C	ON	OFF
More than 37°C	OFF	ON
Range 35°C until 37°C	ON	OFF

Table 4: Temperature Display on The Temperature and Blynk

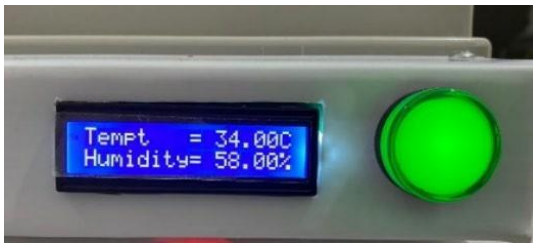
Display on LCD	Display on Blynk
	
	

Table 4 shows the temperature display on the temperature and Blynk. There is a slight error where the display on Blynk is more accurate than the display on LCD. LCD and Blynk display too has been

analyzed using two devices, namely a phone and a laptop. Both devices show the displayed temperature is not fixed with the display on the LCD.

3.2 Discussions

The IoT concept of the product the researcher developed makes it different from the existing product in that it requires less human labour to monitor the laying of chicken eggs. Since no other researcher has before employed this technique, this developed product can also monitor the temperature using the Blynk application. When it comes to price, the product produced is less expensive than the one currently on the market. In contrast to competing items that can cost up to RM 500 or more, this researcher's invention only costs RM 133 for the entirety of its development. The researcher's prototype is not very sturdy in terms of durability because it is made of Styrofoam.

3.2.1 Instrument for Expert Evaluation

Three experts have evaluated this product to confirm the functionality of the Egg Incubator. In the reviews section, all the experts have confirmed the product's functionality and met the set objectives. There are 2 parts of evaluation: design and functionality.

- Product Design Evaluation

There are 7 items to evaluate the egg incubator design. Table 5 shows the result of the evaluation for the expert.

Table 5: Product Design Evaluation

No.	Question	Consent		Total (%)
		Yes	No	
	Casing			
1.	This prototype is in neat condition.	E1, E2, E3		100
2.	This prototype has the appropriate size to accommodate at least 10 chicks at a time.	E1, E2, E3		100
3.	The developed prototype is constructed from heat-resistant materials to maintain a suitable temperature for hatching chicks	E1, E3, E3		100
4.	The developed prototype design is easy for users to handle	E1, E2, E3		100
5.	The developed prototype is easily moved to a suitable location.	E1, E2, E3		100
6.	This prototype is suitable for use in chicken farming areas	E1, E2, E3		100
7.	Arrangement of components such as lights, fans, LCD, movement sensors and temperature sensors are arranged in the appropriate place.	E1, E2, E3		100

E1= Expert 1, E2=Expert 2 and E3=Expert 3

The product design focuses on the design aspects of the egg incubator with *Blynk* notification. The process for designing this product is a step after analysis before the product is fully developed. Expert 3 suggests improving the casing because it is not fully waterproof.

3.1.4 Product Function Evaluation

There are 9 items to evaluate the egg incubator functionality. Table 6 shows the result of the evaluation for the experts. All expert agrees with the question.

Table 6: Product Functionality Evaluation

No.	Question	Consent		Total (%)
		Yes	No	
	Temperature Sensor			
1.	LCD display shows temperature and humidity values	E1, E2, E3		100
2.	This product can control the temperature automatically	E1, E2, E3		100
3.	The fan will turn on when the temperature is greater than 37 °C	E1, E2, E3		100
4.	The light will turn on when the temperature is less than 35 °C	E1, E2, E3		100
5.	This product can detect movement in the incubator	E1, E2, E3		100
6.	A notification display using the Blynk application will be sent to the user's phone when movement is detected	E1, E2, E3		100
7.	The green LED lights up when movement inside the incubator is detected	E1, E2, E3		100
8.	A notification display on the Blynk application will be sent to the user when the temperature exceeds 40 °C	E1, E2, E3		100
9.	A notification display on the Blynk application will be sent to users when the system is not operating	E1, E2, E3		100
10.	This product helps farmers monitor the chick hatching process remotely using the Blynk app	E1, E2, E3		100

E1= Expert 1, E2=Expert 2 and E3=Expert 3

4. Conclusion

Due to a monitoring system that eliminates the need for human monitoring, the incubator system created by this researcher is superior to those on the market. If the user's phone has internet access, users can track temperature data as far as possible. Internet connectivity is incredibly simple and quite prevalent in today's technologically advanced world. Additionally, the created incubator system features an automatic temperature control that can regulate the predetermined temperature range of 35°C to 37°C. Because they don't have to check on the livestock area up to twice a day to make sure the temperature is right for hatching the chicken eggs, farmers find this temperature control to be quite convenient. Overall, the development of this chicken egg incubator prototype can work well as planned.

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