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Prototype of Smart Chicken Poultry with IoT Monitoring

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Abstract: As the Malaysian population keeps increasing, the demand for poultry meat and egg products will keep rising too. To fulfill this poultry demand in Malaysia, one of the options for increasing chicken poultry output product is to build a systematic farm for the poultry chicken. The implementation of Internet of Things (IoT) in poultry chicken will allow a real-time monitoring of the cage by the internet. Blynk software will be used to link the poultry cage with the electronic processor via ESP8266. The growth efficiency of poultry chicken will be monitored and can be measured by using the Feed Consumption Ratio (FCR) method. Some of the sensors are attached to help the ESP8266 to collect the data on the poultry chicken. Temperature and humidity sensor (DHT11), ultrasonic and water level sensor to detect food and water level. Also, this poultry system is built with an alarm notifying system. The abnormal condition for the poultry chicken such as high or low temperature, low food and water level, and the operation of the food motor will notify the user about the problem that occurs on the farm. The collected data is sent to a cloud-based server, Blynk software where it is kept in a database and the result can be used for analysis.

Keywords: Internet of Things (IoT), ESP8266, Feed Consumption Ratio (FCR), DHT11, Blynk Software

1. Introduction

In Malaysia, the agricultural sector plays a major role in becoming one of the sources of income for the country. Referring to Malaysia's GDP in the year 2019, agriculture contribute RM 103.8 billion (7.3%) [1]. For the livestock product, contribute 14.9 % to the Malaysian GDP, focused on meat, RM12.4 billion and egg RM 5.8 billion [1]. Around 37% of poultry meat and 73% of the egg is imported from Malaysia to Singapore [1] and Malaysia is the largest poultry exporter to Singapore. This shows the importance of the poultry sector and industry in creating one of the financial incomes for the country.

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For the food chain and supply, Malaysia holds the top 1 rank in Asia and third in the world for the highest yearly consumption of chicken per capita and for eggs is around 20kg per year [1]-[2]. For ensuring the demand is always lower than the production of the poultry industry in maintaining the continuous supply of poultry products such as chicken meat and egg. The poultry farming system must be improvised and focused on to increase the production output. Malaysia is able to produce around 113.8% of the demand for chicken and eggs and this shows Malaysia's poultry industry is self-sufficient [1].

Poultry is the main source of protein for Malaysians. Refer to the graph "Poultry Consumption Per Capita in Malaysia from 2006-2020 as shown in Figure 1, With Forecast For 2025", shows an increase of around 46.51% in the consumption per capita (in kg) in the year 2025 compared to 2006. The estimated for 2025 is it is surpassed 50 kg consumption per capita [3]. There are a lot of ways to increase the output production of poultry in order to reach at least an optimum quantity of required demand for Malaysian poultry consumption. One of the methods is improving the poultry farming system to keep the continuous production of poultry animals and enough to fulfill the demand for Malaysian poultry consumption.

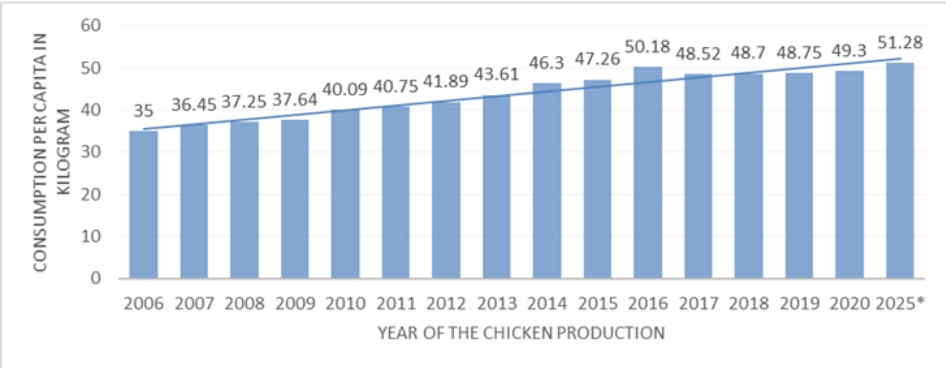

Figure 1: The graph of poultry consumption per capita in Malaysia from 2006-2020, with a forecast for 2025

In Malaysia, most agriculture industries are still using the conventional method to operate. All routines in monitoring and control of chicken poultry farms are using manpower where the source and energy are very limited [4]. Meanwhile, the demand from consumers for the agriculture output is increasing day by day [3] and requires more advanced farming technology in order to obtain maximum efficiency.

The term smart means the system work in an autonomous, device that is linked with Internet of Things and can be controlled via other devices. IoT is a term used to describe infrastructure in which a wide range of items are connected to the internet, resulting in significant changes in how people live and work [5]. For example, the sensor automatically senses if the chicken is in sick condition and warns the owner via notification through the phone. This creates a smart living environment and helps the farmer in improving his management and monitoring skills on the poultry farm.

2. Materials and Methods

2.1 Materials

The list of equipment and component used in this project is ESP8266, DHT11 (Temperature and Humidity sensor), water level sensor, ultrasonic sensor, lamp, buzzer, fan and servo for food. The prototype design of the chicken poultry cage is designed using the tinkercad.com as shown in Figure 2.

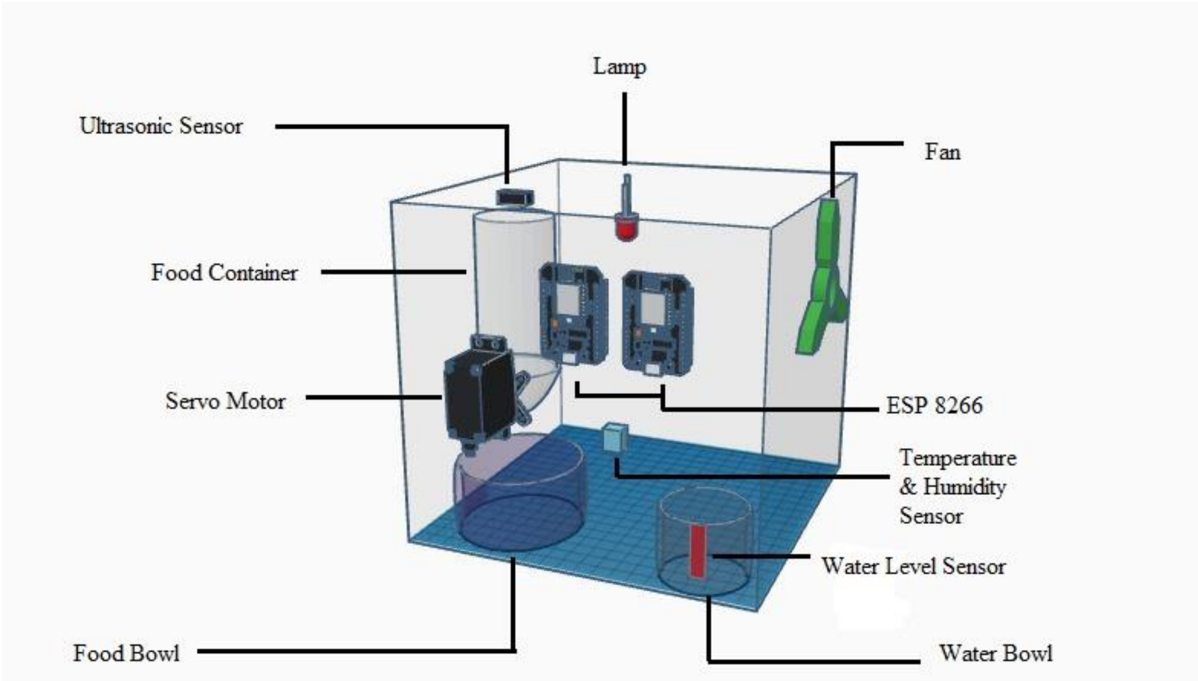

Figure 2: The conceptual 3D design of a smart poultry cage by using tinkercad.com.

2.2 Methods

This methods section explains about the process and the flowchart of the poultry chicken cage.

2.2.1 Overall Project Flowchart

Figure 2 shows the flowchart for the overall process and Figure 4 depicts the process flowchart on the ESP8266 -1.

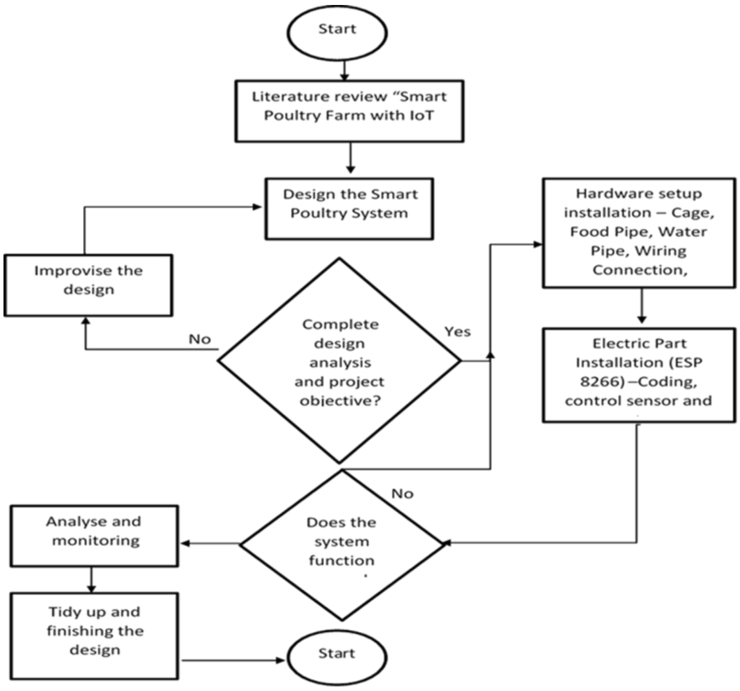

Figure 3: The flowchart of the overall process

2.2.2 Process Flowchart on the ESP8266-1

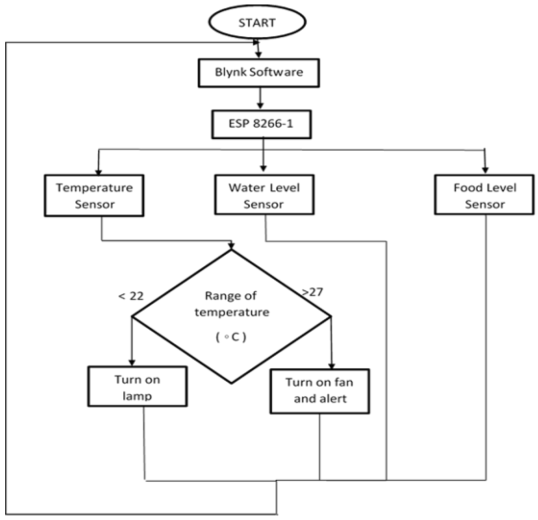

Figure 4: Process Flowchart on the ESP8266 -1

In Figure 4, ESP 8266- 1, the process is specified for the sensor to function. This system use a temperature sensor (DHT11), water level sensor and food level sensor (ultrasonic sensor). On the Blynk (software), it is connected with the ESP8266 -1. Every input received on each sensor will be sent into Blynk using esp8266. The Blynk will present all of the values to the user. A fan and lamp are attached in this system. The temperature value will determine the process of the fan and lamp. In further explanation, when the temperature is lower than 22 ◦C, the lamp will be turned on to heat the ambient temperature of the poultry farm. If the temperature is above 27◦C, the fan will be turned on to cool down the ambient temperature of the poultry farm. If the temperature is in normal condition (between 22 ◦C and 27 ◦C), the fan and lamp will be turned off because it is in a normal state.

2.2.3 Process Flowchart on the ESP8266-2

Figure 5 shows the flowchart for ESP8266-2. On the ESP8266-2, the system relies on delay function. Only food servo is attached to this system. The reason to split the food servo in ESP8266-2 with other sensors in ESP8266-1 is due to the different time functions on each ESP8266. The food servo will be set to trigger and turn for every 12 hours. In general, every day, the food servo will be turned on 2 times. The chicken will be fed every 12 hours.

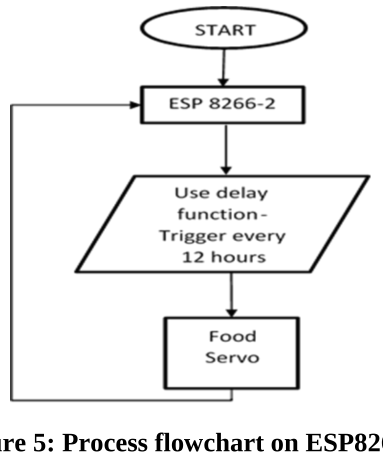

Figure 5: Process flowchart on ESP8266-2

3. Results and Discussion

3.1 Results

Figure 6 shows the connection under real image on the breadboard. Both of the circuit pinout and connection in simulation and in real project is almost same but in real the function of virtual pin is added via Blynk software. This is the prototype of the poultry chicken cage.

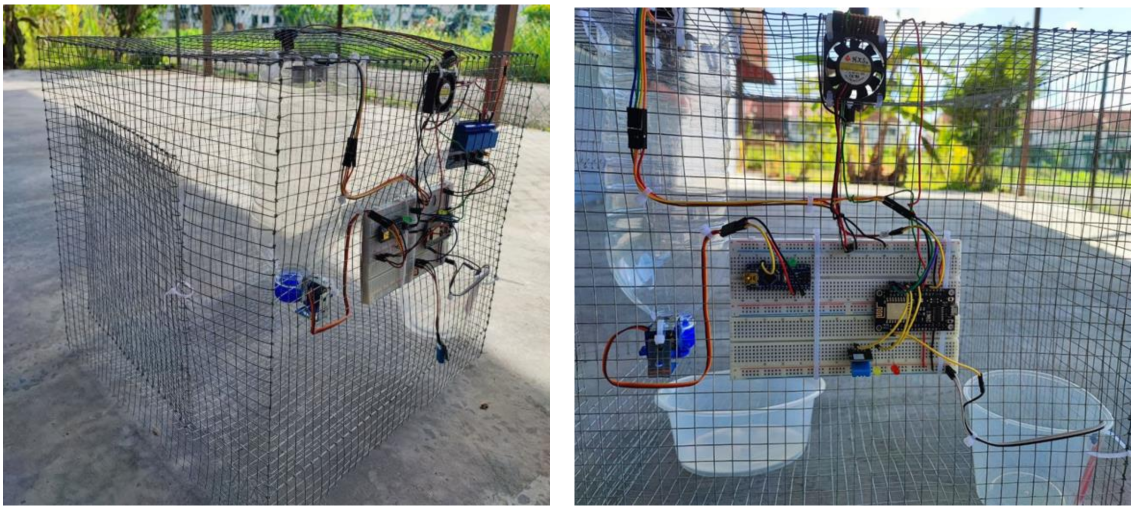

Figure 6: Process flowchart on ESP8266-2

Figure 7 shows the interface of the Blynk software. The Blynk software used in this poultry chicken cage is to monitor the data measured by all of the sensors attached to this cage. It will show the data on temperature, water level and food level. Also, the Blynk software can be used to store the data of poultry chicken in the Blynk cloud.

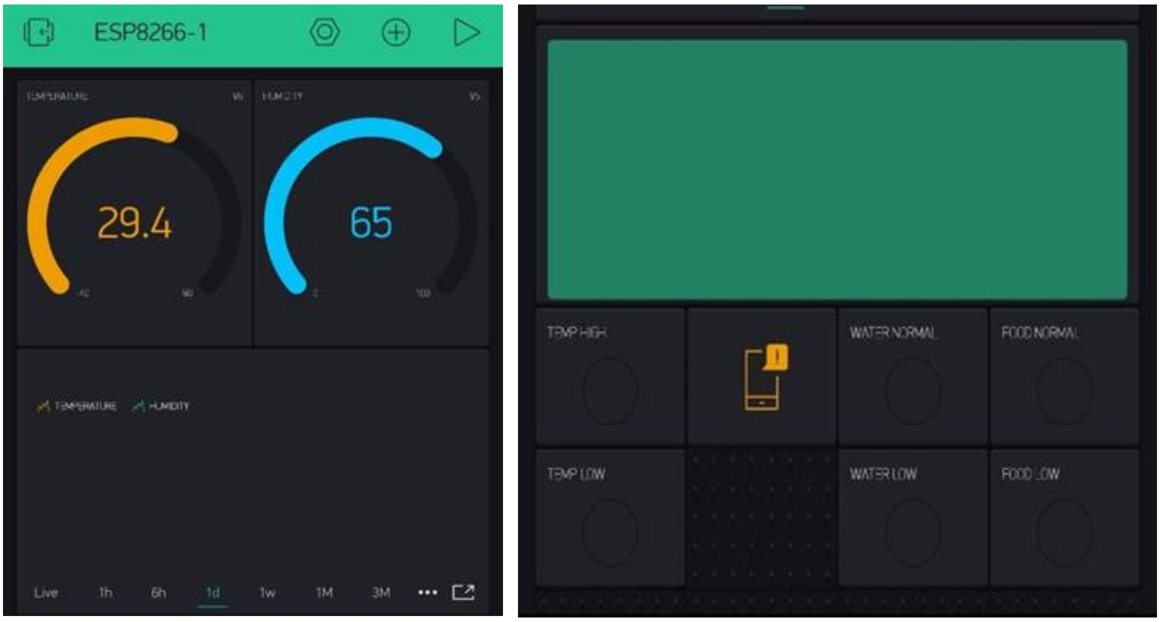

Figure 7: The interface of the Blynk Software

3.2 Discussion

The DHT11 sensor, water level sensor and the ultrasonic sensor is attached to the poultry farm cage. These sensors are used to detect and measure some of the desired parameters needed to run the poultry system.

Table 1 shows the range of temperature and the effect on the poultry system. The lamp and fan will be triggered based on this temperature range. As shown in this table, below the 22 ◦C, the lamp will turn on but the fan will be off to increase the temperature until it's reached the normal temperature range. Also, the virtual led of low temperature will be turned on in the Blynk software to warn the user. For the temperature between 22 ◦C and 26 ◦C, both the lamp and fan will not be turned off because it is in a normal range of temperature. For a temperature more than 26 ◦C, the fan will be turned on and the lamp will be turned off to decrease the temperature in the poultry chicken cage. Also, the virtual led of high temperature will be turned on in the Blynk software to warn the user

Table 1: Range of temperature and the effect on the poultry system

Temperature (◦C)	**Condition**		**Effect**
	Lamp	**Fan**	
< 22	On	Off	The temperature will rise to the normal range of temperature. The virtual led of low temperature will be on in the Blynk
22 <= t =<26	Off	Off	No action is needed because it is in normal condition
< 26	Off	On	The temperature will be decreasing to the normal range of temperature. The virtual led of high temperature will be on in the Blynk

Table 2, table of the level of food and system and the effect on the poultry system. This poultry system used 3 sensors. DHT11 for humidity and temperature sensor, an ultrasonic sensor for food level and a water level sensor for water level indicator. This table explains the program of the ultrasonic sensor for food level and water level sensor for water level. For the ultrasonic sensor, the required data value needed to trigger the ultrasonic sensor is value < 23 to set the level of the food as a normal condition and in the Blynk software it will turn on the virtual led normal. For the value of =>24, the ultrasonic sensor will declare the food as in low level and in the Blynk software it will turn on the virtual led low to warn the user. For the water level sensor, the required data volume is >300 to declare the water level as normal level and it also will turn on the normal virtual led in Blynk. For the data value of the water level sensor at <= 300, it will declare as a low condition for water level and in Blynk it will turn on the low virtual led to warning the user.

Table 2: The level of food and water and the effect on the poultry system

Sensor	System Data Value	Level Condition	Effect
Ultrasonic Sensor	< 23	Normal	The virtual LCD on Blynk will shows the label " Food Level Normal" and the virtual LED will turn on virtual led "Normal"
	= > 24	Low	The virtual LCD on Blynk will shows the label "Food Level Low" and the virtual LED will turn on virtual led "Low" and buzzer.
Water Level Sensor	>300	Normal	The virtual LCD on Blynk will shows the label " Water Level Normal" and the virtual LED will turn on virtual led "Normal" and led
	<= 300	Low	The virtual LCD on Blynk will shows the label "Water Level Low" and the virtual LED will turn on virtual led "Low" and led.

4. Conclusion

The main topic of this thesis is to develop an autonomous smart chicken poultry cage with IoT monitoring. This project is able to create an autonomous poultry food supply system and water feeder. Blynk software is used to keep the data recorded at the poultry farm and can control the poultry farm system. This system is built ESP8266 and uses Blynk software as a medium to interact with user.

Acknowledgement

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