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Smart Fish Crackers Drying Tray

Jeffery Sibat Rentap[1], Nursyafika Saimon[1], Shahrullah Ramaddan Musa[1], Edwin Kayong Rawing[1], Chen Wong Keong[1*]
[1]Department of Mechanical Engineering, Politeknik Mukah, KM7.5 Jalan Oya, 96400 Mukah, Sarawak, Malaysia
*Corresponding author: chenwk2012@yahoo.com

Abstract

Fish crackers are popular food in Southeast Asian nations, particularly Malaysia and Indonesia. Malaysia's cracker-producing states include Kelantan, Terengganu, Pahang, Johor, Kedah, and Sarawak. The freshness of the fish, the type of fish used, the ratio of the primary components, and the preparation technique all influence the quality of the crackers. The seven critical processes in manufacturing and producing fish crackers include cutting fish, mixing all components, forming dough, steaming, slicing crackers, drying, and packaging. The process of drying fish crackers is the most significant step. Due to weather uncertainty, drying fish cracker is a challenging process and human monitor is a laborious process to ensure the fish cracker do not spoil by sudden rain. Therefore, a Smart Fish Crackers Drying Tray with an Internet of Things (IoT) system and renewal solar energy was proposed and developed. This Smart Fish Cracker Drying Tray can store and open the tray from roof within 5 seconds with a motorized system automatically based on weather condition which is controlled by microcontroller WeMos without a human caretaker. This innovation can also monitor the environment's temperature, weather, humidity, and the brightness of sunshine and share the data in cloud accessed by smartphone via Blynk IoT application. The proposed innovation can increase the cracker drying quantity and quality.

Keywords: - Fish cracker, Internet of Things, drying tray

1. Introduction

In Malaysia, fish crackers, also known as ‘keropok ikan’ are a popular and traditional food (Abdul Rashed et al., 2021; Azmiera et al., 2020; Neiva et al., 2011). There are several varieties of fish crackers available in Malaysia, such as prawn crackers, fish ball crackers, and fish fillet crackers (Abdul Rashed et al., 2021; Baishak et al., 2020; Retnaningsih & Ruenda, 2021). Every type has its own distinct flavor and texture. Fish crackers are a popular snack prepared from fish paste or powder combined with flour and other spices. The mixture is often shaped into thin, crisp crackers, which are then baked or deep-fried until crispy. These crackers frequently have a fishy flavor and are popular in many Asian nations. The ingredients and flavors vary, but fish crackers are popular for their crisp texture and savory flavor. They come in a variety of shapes and sizes, ranging from fish to more abstract designs. Some variants may incorporate flavor-enhancing elements such as seaweed, sesame seeds, or spices.

The traditional method for producing fish crackers is to combine fish paste, flour, and spices. To produce the appropriate texture, the mixture is shaped and deep fried or sun-dried. While sun-drying is a traditional method for producing fish crackers, it does provide certain obstacles and possible hazards. Here are a few concerns that can occur with sun-drying fish crackers, such as weather dependency: sun drying is extremely reliant on meteorological conditions. If the weather is gloomy, wet, or humid, drying may be sluggish or inefficient (Kok et al., 2004). Weather variations might affect the final product's quality and uniformity.

Inconsistent Drying: achieving uniform drying can be difficult, especially if the crackers are not flipped often or if the drying conditions are uneven. Inconsistent drying can cause texture and flavour differences between various batches of fish crackers. Time-consuming: sun-drying takes longer than other drying procedures, such as oven drying or industrial methods. Extended drying times might raise the risk of spoiling and reduce overall production efficiency. Sometimes, fish crackers cannot be dried due to bad weather. Hence, the drying process for fish crackers will be slow and take a long time. This problem will cause the fish crackers not to get enough drying and cause them to become limp. Without a drying machine, the number of dry fish crackers produced cannot be enough to meet the market demand (Hamidab et al., 2020).

To address these issues, some producers may mix sun-drying with other processes or use more controlled settings, such as drying rooms or dehydration equipment. This ensures constant quality and mitigates the influence of external factors on fish cracker manufacturing. Therefore, a Smart Fish Crackers Drying Tray with an Internet of Things (IoT) system and renewal solar energy was proposed and developed. The proposed machine can increase the cracker drying process, quantity and quality.

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Developing a smart fish cracker drying tray for sun-drying entails adding technology and design characteristics that overcome some of the issues associated with standard sun-drying methods.

2. Methodology

2.1 Block Diagram

Fig.1 shows the block diagram for Smart Fish Crackers Drying Tray with Internet of Thing (IoT). WeMos will automatically engage the motor to relocate the tray 1 and tray 2 under the roof during poor weather and deploy the trays under the sun during good weather.

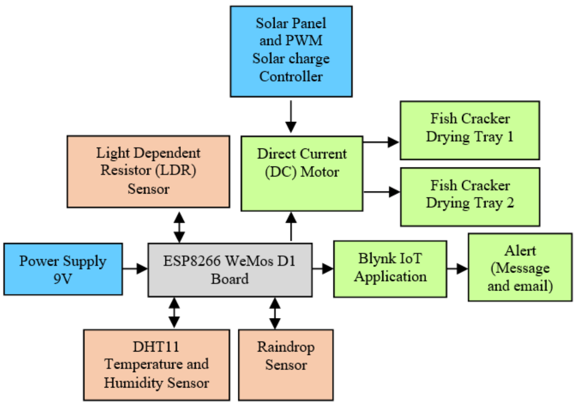

Fig. 1. Block diagram of the proposed system

a) ESP8266 WeMos D1 Board

The ESP8266 WeMos D1 is a development board built on the ESP8266 Wi-Fi module as shown in Fig. 2. It is intended to make it easier for developers to prototype Internet of Things (IoT) technologies (Wong-Keong, 2023). The ESP8266 is a highly integrated Wi-Fi module that supports TCP/IP communication on microcontrollers. It has its own CPU and may be configured separately. The WeMos D1 board's ESP8266 module supports the 802.11 b/g/n Wi-Fi standard. The WeMos D1 board is a development board that combines the ESP8266 module with extra components to facilitate prototyping. The board commonly includes a microcontroller that can be programmed alone or in combination with the ESP8266. The WeMos D1 can be programmed with the Arduino IDE and the

Fig. 2. ESP8266 WeMos D1 board

ESP8266 core. The WeMos D1 board exposes a set of General-Purpose Input/Output (GPIO) pins that can be used to interface with other electronic components such as sensors, actuators, and displays.

b) DHT11 Temperature and Humidity Sensor

The DHT11 is a popular and economical temperature and humidity sensor as shown in Fig. 3. It comes in a tiny module that contains the sensor and a resistor (Ma'arij & Yudhana, 2023). The sensor normally works at 3.3 or 5 volts, making it compatible with most microcontroller systems. The temperature ranges from 0 to 50 degrees Celsius, while the relative humidity ranges from 20% to 90%. The DHT11 sensor measures temperature using a resistive humidity element and a thermistor. The humidity-sensitive component's resistance fluctuates with humidity, whereas the thermistor's resistance varies with temperature. The sensor outputs a digital signal, making it simple to interface with microcontrollers. The DHT11 module typically has three pins: power supply (Vcc), digital signal output (Data), and ground (GND).

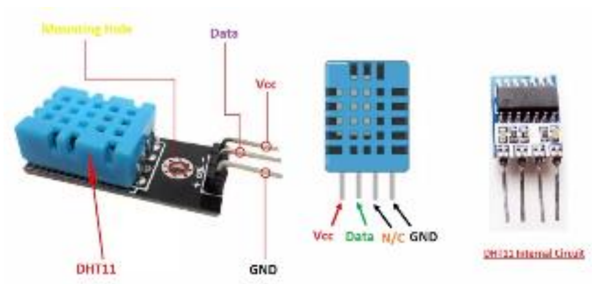

Fig. 3. DHT11 temperature and humidity sensor

c) Raindrop Sensor

A raindrop sensor detects the presence of raindrops or water droplets as illustrated in Fig. 4. It is utilized in weather monitoring systems when detection of rainfall is essential. Raindrop sensors generally operate based on conductivity. They are composed of conductive lines on the sensor surface. When raindrops fall on the surface, they form a conductive route between the traces. The sensor surface is frequently composed of a substance that conducts electricity, such as metal or conductive polymer. Raindrop sensors is connected to the microcontroller WeMos to provide rainfall detection in this innovation

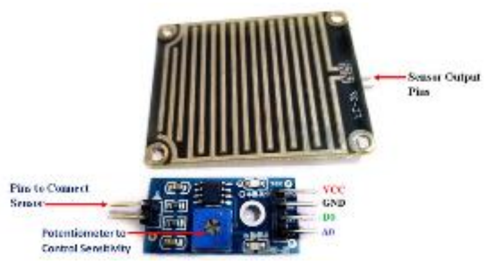

Fig. 4. Raindrop sensor

project. Microcontrollers can read the sensor's output and perform actions or display data based on the rainfall conditions.

d) Light Dependent Resistor (LDR) Sensor

Fig. 5 shows a Light Dependent Resistor (LDR), commonly known as a photoresistor, is a resistor whose resistance varies with the amount of light falling on it. LDRs are frequently utilised in a variety of applications involving light sensing. An LDR's resistance reduces as the intensity of light shining on it increases. In contrast, resistance rises in low-light or darkness. LDRs are generally composed of highly resistant semiconductor materials. LDRs may be connected to the WeMos microcontroller to generate a digital or analogue signal dependent on the brightness of ambient light. The microcontroller can then utilise this data to operate other devices or perform specified tasks.

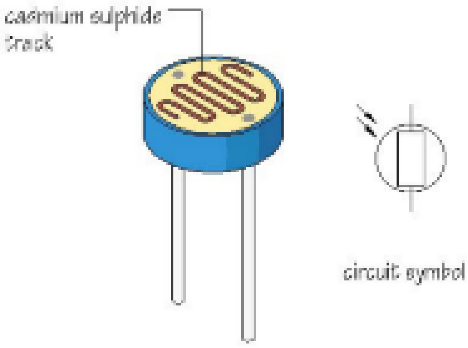

Fig. 5. LDR Sensor

e) Direct Current (DC) Motor

A direct current (DC) motor is a type of electrical equipment that uses direct current to generate mechanical power as shown in Fig. 6. DC motors work on the concept of electromagnetic induction. When a current-carrying conductor is put in a magnetic field, it receives a force that causes the motor to revolve. DC motors are made up of a stator with windings that generate magnetic fields and a rotor with conductors that transport electric current. A DC motor's rotational direction can be changed by switching the polarity of the supplied voltage or adjusting the rotor winding connection.

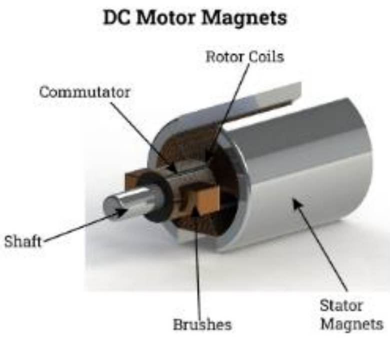

Fig. 6. Direct current (DC) motor

f) Solar Panel and PWM Solar Charge Controller

Fig. 7 shows a solar panels and PWM (Pulse Width Modulation) solar charge controllers are critical components of every solar power system (Faizal et al., 2023). Solar panels, or photovoltaic (PV) panels, use the photovoltaic effect to turn sunlight into energy. When sunlight strikes the solar cells in the panel, it produces direct current (DC) power. Solar panels are composed of many solar cells linked in series or parallel to generate the necessary voltage and current output. They are usually enclosed in a protective frame with a glass or tempered glass cover to safeguard the cells.

A solar charge controller is a necessary component for off-grid solar power systems. Its principal role is to manage the voltage and current from the solar panels so that the battery bank may be charged effectively without being overcharged or damaged. PWM solar charge controllers employ Pulse Width Modulation to regulate the charging process. PWM controllers rapidly turn on and off the charging current, ensuring that the battery voltage remains constant. While PWM controllers are useful, they are older technology than Maximum Power Point Tracking (MPPT) controllers, which are more sophisticated. Charge controllers frequently contain overcharge prevention, deep discharge protection, temperature correction, and low voltage disconnect. They might also feature LED indicators or digital displays to illustrate the battery state.

Fig. 7. Solar panel and PWM solar charge controller

g) Blynk IoT Application

Blynk is a popular platform for developing Internet of Things (IoT) applications as presented in Fig. 8. It provides a simple way to build mobile applications to control and monitor IoT devices (Marniati et al., 2023; Zefi et al., 2022). In this project, the Blynk is setup involves a hardware device ESP8266 WeMos D1 Board and connected to DHT11 Temperature and Humidity Sensor, Raindrop Sensor, and LDR Sensor. Then, the mobile app can be created by using the Blynk platform.

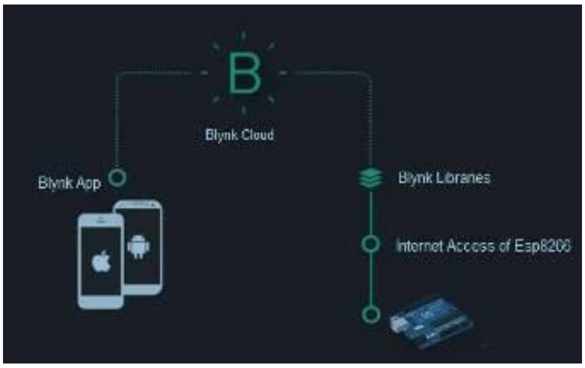

Fig. 8. Blynk IoT application

2.2 Software Arduino (IDE)

Fig. 9 shows the programming flow chart for Smart Fish Crackers Drying Tray. This flow chart begins with readings from the LDR sensor, the temperature and humidity sensor, and the raindrop sensor to determine the tray placement for this project. According to the code, a value of less than 50 on the LDR sensor indicates that the tray is in a dark environment with no sunlight detected. The temperature and humidity readings may be obtained via the DHT11 sensor used in this project. Meanwhile, the rain sensor could identify the presence of raindrops with a value greater than 800. Based on the readings from all these sensors, WeMos will automatically engage a motor to move the tray under the roof during poor weather and deploy the tray under the sun during good weather.

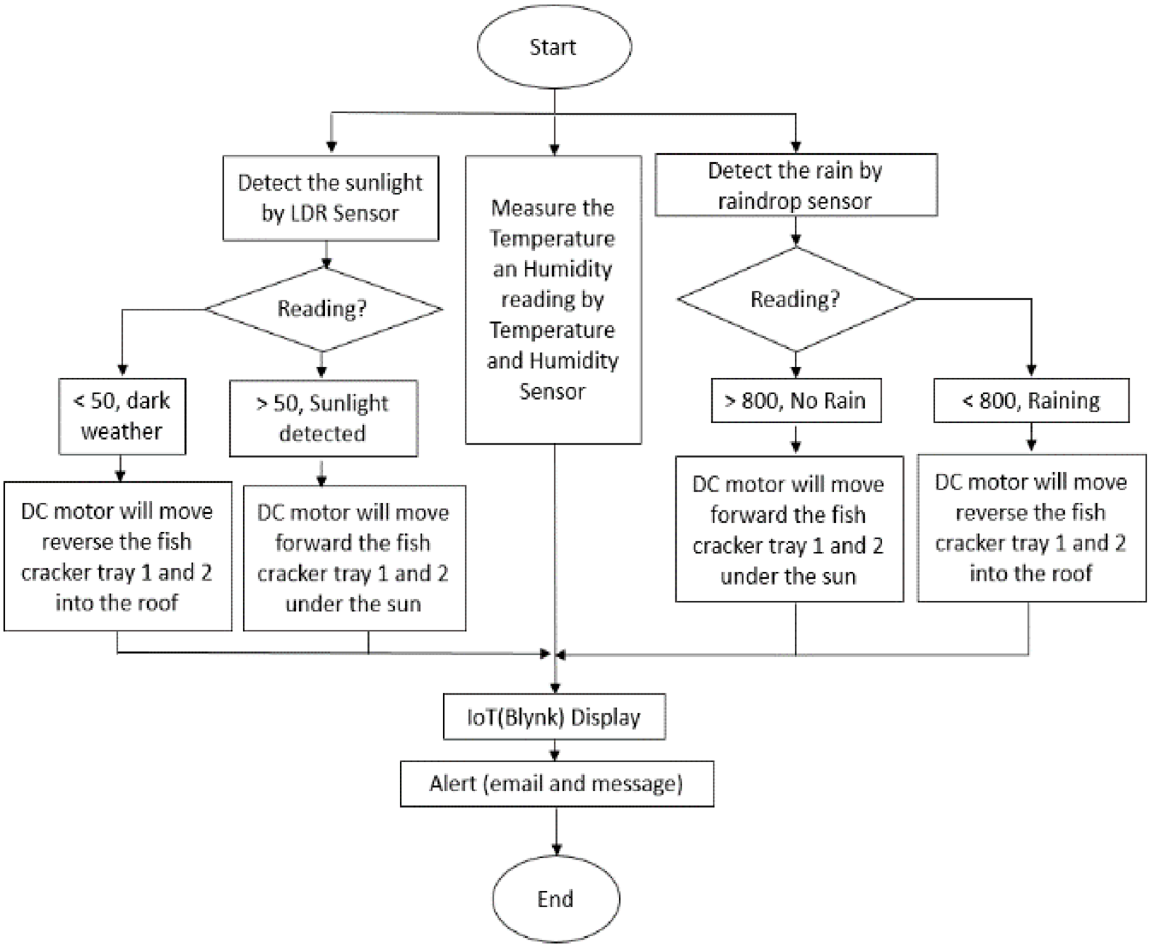

Fig. 9. Flow chart of proposed system

2.3 Casing Design

Fig. 10 shows the casing design for Smart Fish Crackers Drying Tray.

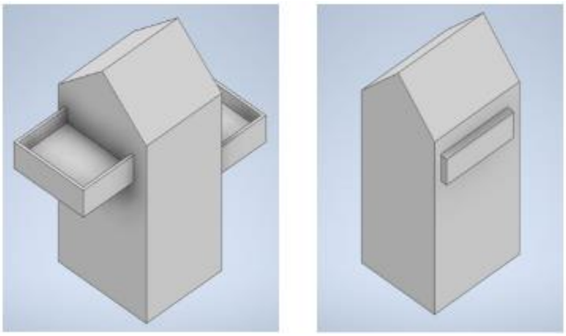

Fig. 10. Casing design for fish cracker drying tray 1 and tray 2

3. Results and Discussion

The following section shows the results of the project at different stages of development. Fig. 11. shows the schematic diagram of Fish Cracker Drying Tray. From Fig. 11, WeMos D1 R1 is the main controller of the system which relates to important sensors such as temperature and humidity sensor, raindrop sensor, and LDR sensor to get the input of the weather condition of the environment. WeMos D1 R1 is connected to Blynk IoT in order the sensor data could be accessible as smartphone application to control the system. WeMos D1 R1 is programmed to start the movement of the DC motor based on the weather condition to deploy the trays under the sun or keep the trays under the roof automatically.

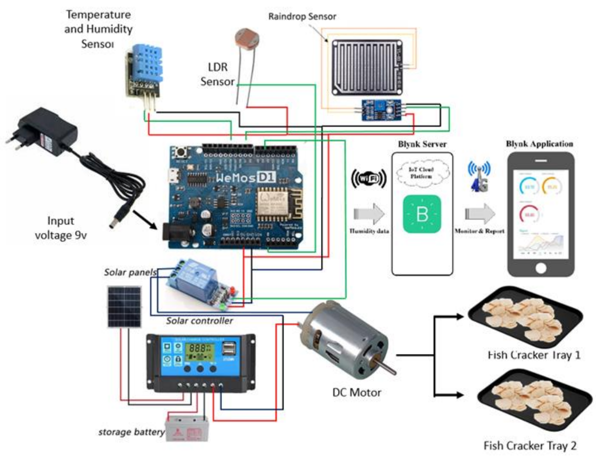

Fig. 11 Schematic diagram of fish cracker drying tray

At this stage, a prototype of Smart Fish Cracker Drying Tray has been completed and has been tested for its functionality. All the sensors, motor mechanism, solar system and system IoT have been installed and tested for its functionality and all components work as desired. The Fish Cracker Drying Tray (front view) and (side view) are shown in Fig. 12(a) and Fig. 12(b) respectively. With the solar panel attached at the roof top, it could be able to charge the battery during the day for actuating the DC motor to control both trays.

(a) (b)

Fig. 12. Fish cracker drying tray (a) front view, (b) sideview

Fig. 13 shows the Blynk application on smartphone which could monitor the weather condition of the cracker drying environment with sunlight reading temperature and humidity reading. Besides, this application also shows the position of the tray whether is under the sun or under the roof. When rain drop detected, this application will give the alarm of raining and motor will be activated to keep the tray under the roof as shown in Table 1.

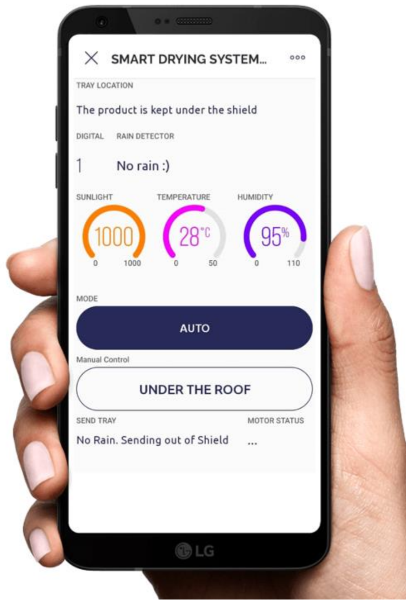

Fig. 13. Blynk Application on smartphone

Table 1. Result and finding

Testing	Sunlight Detected by LDR Sensor	Rain Detected by Raindrop Sensor	DC Motor Movement
Testing 1	Yes	No	Move Forward
Testing 2	No	Yes	Move Reverse

4. Conclusion

In conclusion, a smart cracker drying trays was created successfully for natural drying process without laborious human monitoring. This innovation able to take appropriate action automatically based on the environmental condition. The trays able to move under/ out of the roof within 5 seconds based on the environment condition smartly and it is powered by green energy from solar panel.

Acknowledgement

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