MANUFACTURE OF COOKING OIL CONTENT DRAIN CONTROL DEVICE IN OILY FOODS USING THE ESP32-BASED AND FUZZY LOGIC METHOD

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Abstract

Cooking oil is an essential commodity in everyday life in Indonesia, with palm oil consumption reaching 18.5 million tons in 2021, according to the Indonesian Palm Oil Association (GAPKI). High levels of consumption can potentially increase the risk of health problems. To reduce oil consumption, slicing of food is required. However, this process is often done manually, which is less effective. Therefore, this study proposes the development of an automatic control device using the YF-S201 flow sensor, TCS3200 color sensor, and DS18B20 temperature sensor, which then processes the data using the fuzzy logic method. Data processing and monitoring are performed using ESP32, displaying results on the LCD and website. Data is stored in a MySQL database. The test was conducted on shrimp crackers weighing 0.5kg for 1 minute 25 seconds. This control device is hoped to help households, traders, and MSMEs as an effective and efficient solution. The characteristics of the three sensors, namely the TCS3200 colour sensor, flow sensor YF-S201, and temperature sensor DS18B20, it was found that the sensor had worked well as expected, with a maximum error percentage of 0.91%. In one of the tests to drain oil on oily crackers, the oil flow was detected to be 0.07 litres/minute of oil flowing out of the oil filter.

Keywords: Cooking oil strainer tool, Fuzzy Logic method, TCS3200 color sensor, YF-S201 flow sensor, DS18B20 temperature sensor

Abstrak

Minyak goreng merupakan komoditas penting dalam kehidupan sehari-hari di Indonesia, dengan konsumsi minyak kelapa sawit mencapai 18,5 juta ton pada tahun 2021, menurut Gabungan Pengusaha Kelapa Sawit Indonesia (GAPKI). Tingkat konsumsi yang tinggi berpotensi meningkatkan risiko gangguan kesehatan. Untuk mengurangi konsumsi minyak, diperlukan proses penirisan kandungan minyak pada makanan. Namun, proses ini sering kali dilakukan secara manual sehingga kurang efektif. Oleh karena itu, penelitian ini mengusulkan pengembangan alat kontrol otomatis penirisan kandungan minyak pada makanan dengan menggunakan beberapa sensor yaitu sensor aliran YF-S201, sensor warna TCS3200, dan sensor suhu DS18B20, dimana algoritma pengolahan datanya menggunakan metode logika fuzzy. Mikrokontroler pengolahan data dan monitoring menggunakan ESP32, luaran ditampilkan pada *LCD* dan *website*. Data disimpan dalam database MySQL. Pengujian dilakukan pada kerupuk udang dengan berat 0,5 kg selama 1 menit 25 detik. Alat kontrol ini diharapkan dapat membantu rumah tangga, pedagang, dan UMKM sebagai solusi yang efektif dan efisien. Dari hasil pengujian karakteristik ketiga sensor, yaitu sensor warna TCS3200, sensor aliran YF-S201, dan sensor suhu DS18B20, didapatkan bahwa sensor telah bekerja dengan baik sesuai dengan yang diharapkan, dengan persentase kesalahan maksimum sebesar 0,91%. Pada salah satu pengujian untuk meniriskan kandungan minyak pada kerupuk berminyak, aliran minyak terdeteksi sebanyak 0,07 liter/menit yang mengalir keluar dari saringan minyak.

Kata kunci: Alat peniris minyak goreng, metode Fuzzy Logic, sensor warna TCS3200, sensor aliran YF-S201, sensor suhu DS18B20.

1. Introduction

Cooking oil is one of the daily staples used by the people of Indonesia; almost all Indonesian households use this staple. In addition to giving a savoury taste, frying food using oil will give it a more pleasant aroma and crispier texture and increase its nutritional value [1]. The Indonesian Palm Oil Association (GAPKI) noted that palm oil consumption in Indonesia was 18.5 million tons in 2021. This number increased by 6.63% from the previous year, which amounted to 17.35 million tons and became the largest since 2015 [2].

Consumption of oily foods such as chips, crackers, and fried foods has become common in our society. It is even a source of livelihood for traders and MSMEs. Based on a BRI Research Institute survey with more than 7,000 MSME respondents in Indonesia, 42.7% of MSME players use cooking oil as raw material for production activities [3]. People often repeat the use of cooking oil for reasons of cost savings. Even though repeated use of cooking oil can damage the quality of the cooking oil. Eating oily foods excessively is undoubtedly not good for the body and increases the risk of health problems, including cardiovascular disease, diabetes, cancer, and obesity [4]. This is caused by increased peroxide compounds in cooking oil content in the repeated use of cooking oil [5].
Repeated use of cooking oil will damage the quality of cooking oil. This is due to the increase in free fatty acids from cooking oil, which will trigger changes in viscosity, density, and others in cooking oil [6]. With this increase, it will also cause an increase in systemic inflammation, which has an impact on heart failure and sudden death. In addition, repeated heating of the oil will also form trans fats in the oil. According to some studies, consumption of trans fats is very harmful to health, especially in large amounts and continuously [7]. One way to avoid this risk is to reduce the oil content contained in food through the slicing process. The oil-slicing process is on a household scale, and MSMEs still use manual or traditional methods. Time efficiency in producing Micro, Small, and Medium Enterprises (MSME) products is crucial to maintaining sustainability and business growth [8]. Based on these problems, a cooking oil slicer is needed in food to produce food with low oil content following the recommended levels. The slicing machine works based on a centrifugal system by rotating a container containing high-speed food so that the oil will remove the food oil [9].

In 2022, Fani Oktawirna and Mukhlidi Muskhir explained the design of an automatic cooking oil slicer on cassava chips. The system determines the playtime based on the volume of food drained [10]. In 2019, Lis Diana, Hadiwiyatno, and Yani Ratnawati developed an oil filtration control system using ESP32 that is connected through a smartphone based on a timer [11] While this study will focus on the output of drained oil as an indicator. This control device can be manufactured using the YF-S201 Flow Sensor, TCS3200 colour sensor, and DS18B20 temperature sensor. The YF-S201 Flow Sensor is used to measure the outflow of oil from slicing based on the incoming oil passing through the mill on the sensor, while the colour sensor, TCS3200, helps measure the colour of cooking oil. The DS18B20 sensor is also tasked with detecting changes in oil temperature when the spinner is spinning. The reading data will be processed using fuzzy logic methods. Linguistically, fuzzy logic is defined as a vague logic between right and wrong, which can also be interpreted in theory as a value that can be true or false simultaneously. But how much does the value of truth and error depend on the value of membership owned [12]. The output produced is the on or off command on the oil slicer, which the Solid-State Relay will set. ESP32 will send sensor reading data using a WIFI connection to be stored in a MySQL database and displayed on the website.

2. Research Methods

Research methods are used as a reference in research, including collecting information through literature studies, system design, data processing, and implementation so that it can run well and be realized.

2.1. Block Diagram of the System

In general, in its manufacture, sensors detect changes in conditions during the oil slicing process, which is carried out as an indicator of control of oil content slicers. Here's a diagram that shows the flow of the system in action are shown in Figure 1.

Based on the illustration of the system design above, the input is oily food being drained using an oil slicer. When the spinner rotates, the oil will come out of small holes on the edge of the tube, which will then come out on the other side of the oil slicer to be accommodated. The YF-S201 flow sensor will measure the flow discharge of oil flowing through the pinwheel inside the sensor. When the oil flows, the mill will automatically rotate. The sensor will work by calculating the rotational speed of the rotor in the wheel. Frequency characteristics compared to the amount of fluid that crosses the sensor [13]. The TCS3200 colour sensor will measure the colour of the oil drained by reading the intensity of light emitted by the super bright LED on objects where each colour illuminated will reflect the light and determine RGB based on its wavelength [14]. The DS18B20 sensor is also tasked with detecting changes in oil temperature when the spinner is spinning. The advantage of this sensor is that it does not require an ADC to communicate with the microcontroller because it is equipped with 1-wire communication [15] to process data from sensor readings using ESP32.

Furthermore, the data obtained from the three sensors will be processed using fuzzy logic methods for decision-making that the food being drained has reduced its oil content. The output produced is the on or off command on the oil content drainer. If the resulting knowledge is off, oil is no longer flowing, there is a lot in the container, and the temperature has changed. The SSR component will disconnect the motor power on the spinner so it will stop rotating. Data from readings by the sensor will be displayed on the LCD. ESP32, with the help of an internet connection, will send all data to the MySQL database to be stored. Then, the data will be visualized on the website as dashboards, graphs, and tables. Users can observe the data captured during the process informatively.

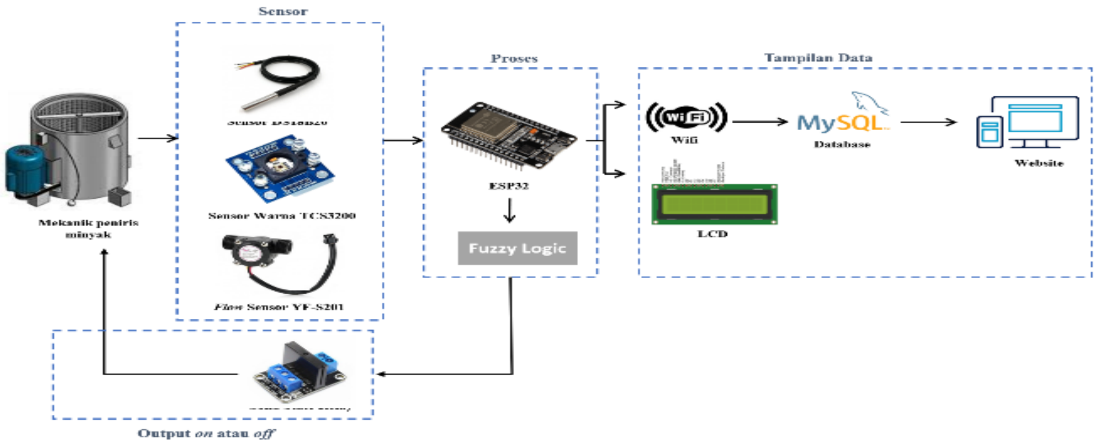

Figure 1. System design

2.2. Data Processing Using Sugeno's Fuzzy Logic Method

A fuzzy logic method is needed to process the sensor reading data into a decision on the control of the on and off of the oil content drainer. Sugeno's fuzzy logic will then be combined into the program to become an overall system for system design to work. A fuzzy inference system is a mechanism for concluding fuzzy logic using multiple rules. FIS (Fuzzy Inference System) combines precise values as input and regulations within the framework of fuzzy logic laws [16]. The steps in data processing with fuzzy logic are shown in Figure 2.

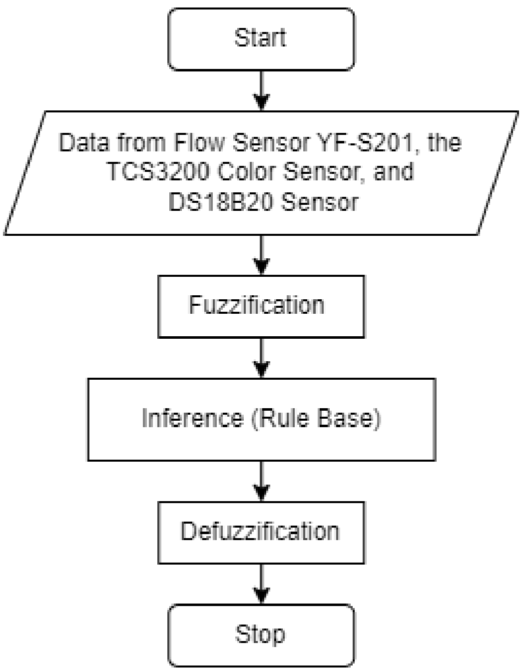

Figure 2. Fuzzy logic flowchart

In this stage, input and output variables are determined, which will be the universe of conversation in this method before the sensor data is processed and entered into the fuzzification step. The criteria for fuzzy input and output variables are shown in Table 1.

Table 1. Input and output variable criteria

Name	Description	Role
Colour	TCS3200 Color Sensor	Input Variables
Flow	YF-S201 Flow Sensor	Input Variables
Temperature	DS18B20 Temperature Sensor	Input Variables
Control	Input SSR	Output Variables

After determining the input and output variables, a fuzzy set is formed for each input variable. Each fuzzy set will be a classification in determining the condition of the sensor reading data as shown in Table 2.

Table 2. Fuzzy Set

Variable		Fuzzy Set	
Name	Notation	Name	Notation
		Dark	G
Colour	A	Turbid	K
		Bright	T
		Very slow	S
Flow	B	Slow	L
		Swift	D
		Normal	N
Temperature	C	Warm	H
		Hot	P

2.2.1. Fuzzification

Each input variable's membership function and curve, including colour, flow, and temperature variables, will be explained in the fuzzification stage. This process aims to convert firm values into linguistic variables in the presence of a membership function. The membership function is a curve showing the mapping of data input points into membership values with intervals between 0 and 1 [17] as shown in Figure 3.

1) Colour Variable

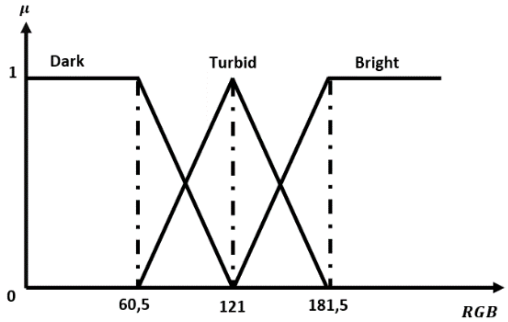

Figure 3. Colour variable membership curve

The membership function of the colour variable as shown in Equation 1 until 3.

$$(Dark)\mu\, G = \begin{cases} 0; & A \geq 121 \\ \frac{121-A}{121-60,5}; & 60,5 \leq A \leq 121 \\ 1; & A \leq 60,5 \end{cases} \quad (1)$$

$$(Turbid)\mu\, K = \begin{cases} 0; & A \leq 60,5 \\ \frac{A-60,5}{121-60,5}; & 60,5 \leq A \leq 121 \\ \frac{181,5-A}{181,5-121}; & 121 \leq A \leq 181,5 \\ 0; & A \geq 181,5 \end{cases} \quad (2)$$

$$(Bright)\mu\, T = \begin{cases} 0; & A \leq 121 \\ \frac{A-121}{181,5-121}; & 121 \leq A \leq 181,5 \\ 1; & A \geq 181,5 \end{cases} \quad (3)$$

2) Flow Variable

For flow variable's membership function and curve, including very slow, slow and swift as shown in Figure 4.

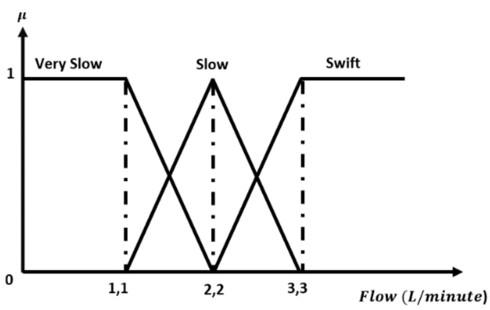

Figure 4. Flow variable membership curve

The membership function of the flow variable as shown in Equation 4 until 6.

$$(Very\ Slow)\mu\, S = \begin{cases} 0; & B \geq 2,2 \\ \frac{2,2-B}{2,2-1,1}; & 1,1 \leq B \leq 2,2 \\ 1; & B \leq 1,1 \end{cases} \quad (4)$$

$$(Slow)\mu\, L = \begin{cases} 0; & B \leq 1,1 \\ \frac{B-1,1}{2,2-1,1}; & 1,1 \leq B \leq 2,2 \\ \frac{3,3-B}{3,3-2,2}; & 2,2 \leq B \leq 3,3 \\ 0; & B \geq 3,3 \end{cases} \quad (5)$$

$$(Swift)\mu\, D = \begin{cases} 0; & B \leq 2,2 \\ \frac{B-2,2}{3,3-2,2}; & 2,2 \leq B \leq 3,3 \\ 1; & B \geq 3,3 \end{cases} \quad (6)$$

3) Temperature Variable

For temperature variable's membership function and curve, including normal, warm and hot as shown in Figure 5.

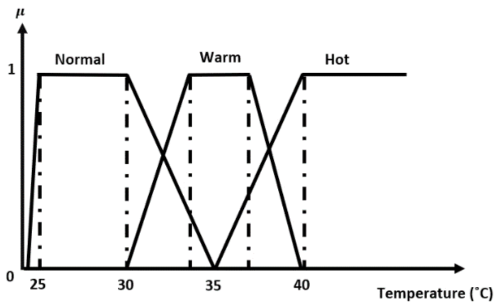

Figure 5. Temperature variable membership curve

The membership function of the temperature variable as shown in Equation 7 until 9.

$$(Normal)\mu\, N = \begin{cases} 0; & x < 25;\ x \geq 35 \\ \frac{35-x}{35-30}; & 30 < x \leq 35 \\ 1; & 25 \leq x \leq 30 \end{cases} \quad (7)$$

$$(Warm)\mu\, H = \begin{cases} 0; & x < 30;\ x > 40 \\ \frac{x-30}{35-30}; & 30 < x < 35 \\ \frac{40-x}{40-35}; & 35 \leq x < 40 \\ 1; & 33 \leq x \leq 38 \end{cases} \quad (8)$$

$$(Hot)\mu\, P = \begin{cases} 0; & x < 35 \\ \frac{x-35}{40-35}; & 35 \leq x \leq 40 \\ 1; & x \geq 40 \end{cases} \quad (9)$$

The formation of curves and membership functions of temperature variables refers to research conducted by Yudha Dwi and Mozart Wilson as literature material [18].

2.2.2. Determining Inference (Rule Base)

In this stage, fuzzy rules are formed, which will later be expressed as a form of IF... THEN. From the set of variables created, 27 rule bases are included, as shown in Table 3.

Table 3. Rule Base

Rule	IF			THEN
	Colour	Flow	Temperature	
R1	Dark	Very Slow	Normal	Off
R2	Dark	Very Slow	Warm	Off
R3	Dark	Very Slow	Hot	On
R4	Dark	Slow	Normal	Off
R5	Dark	Slow	Warm	On
R6	Dark	Slow	Hot	On
R7	Dark	Swift	Normal	On
R8	Dark	Swift	Warm	On
R9	Dark	Swift	Hot	On
R10	Turbid	Very Slow	Normal	Off
R11	Turbid	Very Slow	Warm	On
R12	Turbid	Very Slow	Hot	On
R13	Turbid	Slow	Normal	On
R14	Turbid	Slow	Warm	On
R15	Turbid	Slow	Hot	On
R16	Turbid	Swift	Normal	On
R17	Turbid	Swift	Warm	On
R18	Bright	Swift	Hot	On
R19	Bright	Very Slow	Normal	On
R20	Bright	Very Slow	Warm	On
R21	Bright	Very Slow	Hot	On
R22	Bright	Slow	Normal	On
R23	Bright	Slow	Warm	On
R24	Bright	Slow	Hot	On
R25	Bright	Swift	Normal	On
R26	Bright	Swift	Warm	On
R27	Bright	Swift	Hot	On

Fuzzy inference is designed to be divided into 2: On and Off decisions, which then become outputs or decisions from determining rule base rules using IF... THEN. The following is a fuzzy inference graph shown in Figure 6.

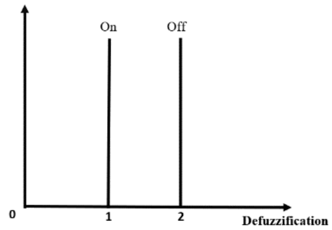

Figure 6. Inference

This inference process will process the value obtained in the fuzzification process. Sugeno's fuzzy method at this stage is similar to the Mamdani method, which uses the MIN implication function to find the smallest value of each rule base to get an α-predicate deal. Every α-predicate is related to the linguistic value of consequent output [19]. Then, the α predicate value of each rule will go to the defuzzification stage. Sugeno FIS shares similarities with Mamdani FIS in several respects, yet it deviates significantly in the consequent part. In Sugeno FIS, the rule resulting is expressed through a mathematical function of the input, while Mamdani, in contrast, utilizes a fuzzy set as the rule consequent [20].

2.2.3. Defuzzification

The defuzzification process in the Sugeno method is carried out by finding the average value or weight average, which aims to convert the results of the inference system into crisp numbers [21].

$$WA = \frac{a_1 z_1 + a_2 z_2 + \ldots a_n z_n}{a_1 + a_2 + \ldots a_n} \quad (10)$$

Where,
WA = Average score
αn = value of the predicate of the nth rule
zn = nth index of output value (constant).

Equation 10 will get an output value that is not a membership function but a number that changes linearly to input variables based on the rule base table [22]. The z value of the index output (constant) is described earlier in Figure 6. So that α predicate will be multiplied by the weight of z, where:

- zn has a value of 1 if, in the rule base, the decision is On
- zn has a value of 2 if the rule base decision is Off

So, it can be written as:

$$WA = \frac{(\mathrm{R1}*(2)) + (\mathrm{R2}*(2)) + (\mathrm{R3}*(1)) + \ldots + (\mathrm{R27}*(1))}{\mathrm{R1} + \mathrm{R2} + \mathrm{R3} + \ldots + \mathrm{R27}} \quad (11)$$

2.3. Website and Database Planning

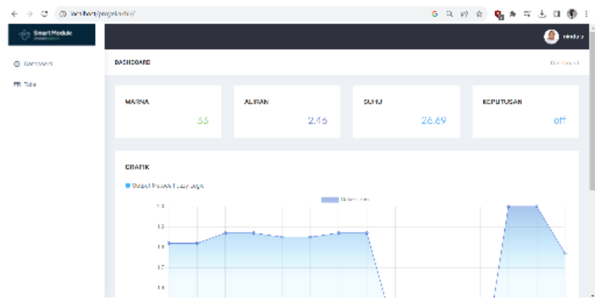

Figure 7. Dashboard

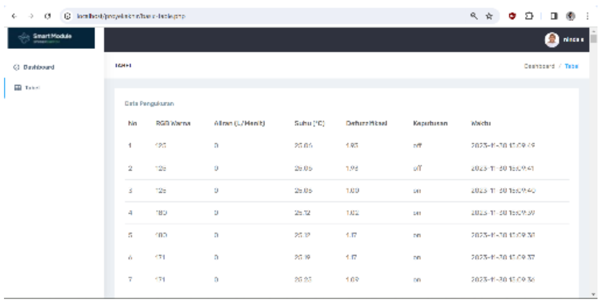

Figure 8. Table Page

The website will be designed in such a way as a dashboard page display that serves to present monitoring data. The dashboard page will contain information about the reading results of the three sensors in real-time on the value card, with the duration of incoming data changes every 1 second. In addition, there is also a graph that shows data on the results of the defuzzification process. Data entered previously will be entered into the sequential table according to the delivery time. Website creation will utilize PHP and HTML languages. PHP is a server-side embedded script language, meaning that all syntax and program commands you write will be entirely executed by the server but can be embedded in regular HTML pages [23]. Then, to make it more attractive in presenting website design, CSS and Bootstrap features are used in its creation. The designed dashboard view is shown in Figure 7. The data in the form of a table view is shown in Figure 8.

This research used a MySQL database named "db_data," It also created a table that stores data sent by sensors according to their type. The table called "monitoring" is shown in Figure 9. The utilization of MySQL is primarily due to its advantages in query speed. MySQL can be up to ten times faster than PostgreSQL and five times faster than Interbase [24].

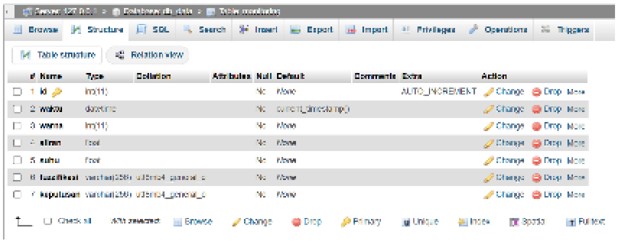

Figure 9. Database MySQL

3. Results and Discussion

The results and discussions include a series of tests, the implementation of control devices on oil slicers, and analysis related to test results.

3.1. Design Results of Cooking Oil Content Drain Control Device

The following is the display of the control device that has been created as shown in Figure 10.

The parts of the cooking oil slicing control device include:

a) The TCS3200 Color Sensor was placed close to oil output channels in drained oil reservoirs. It functions to detect changes in oil colour as the volume of oil increases.
b) The YF-S201 flow sensor is placed on the oil output channel so that the drained oil will pass through the sensor. It functions to detect the discharge of the outgoing oil flow.
c) The DS18B20 temperature sensor was placed between the tubes of the oil slicer. It functions to detect temperature changes during the process.
d) LCD will display sensor reading data and spinner status.
e) Capacitive touch sensors are more sensitive and often respond differently to various types of touches [25]. It functions as a start button, so the spinner rotates and processes data using fuzzy logic.

Figure 10. The design result of the device

3.2. The Test Result and Discussion

Several tests are conducted in this research, including testing the TCS3200 colour sensor, the YF-S201 flow sensor, the DS18B20 temperature sensor, and overall system testing.

3.2.1. Testing of the TCS3200 Color Sensor

This test is conducted by detecting the RGB in cooking oil, where the obtained values will serve as inputs for the fuzzy logic method to form the membership functions of the colour variable as shown in Table 4.

Table 4. Testing TCS3200 Colour Sensor

Number	R	G	B	Output
1	183	124	117	Red
2	181	123	113	Red
3	178	144	127	Red
4	176	121	112	Red
5	174	119	111	Red
6	171	112	102	Red
7	169	105	100	Red
8	164	99	95	Red
9	161	96	91	Red
10	159	82	88	Red

Based on Table 4, when testing, it was found that what was detected was red, so the value that would be taken later as input for the fuzzy logic method was red (R-value in RGB). When oil has a small volume or, in other words, a long distance from the sensor, then the value will be better. Then, if cooking oil has more volume or, in other words, is close to the sensor, then the matter will be lower or decrease. It is also known that the colour of cooking oil will be darker and less transparent to the container base as the volume increases.

3.2.2. Testing of the YF-S201 Flow Sensor

This sensor test is conducted to observe the output values from the sensor readings at different flow rates so that a reading value that can be compared according to the behaviour given will be obtained as shown in Table 5.

Table 5. Testing YF-S201 flow sensor

Number	Time	Output (L/min)
1	16:46:07.122	0.07
2	16:46:07.170	0.15
3	16:46:07.217	0.22
4	16:46:07.264	0.30
5	16:46:07.312	0.37
6	16:46:07.360	0.45
7	16:46:07.407	0.52
8	16:46:07.455	0.60
9	16:46:07.503	0.67
10	16:46:07.550	0.74
11	16:46:07.598	0.82
12	16:46:07.645	0.89
13	16:46:07.694	0.97
14	16:46:07.741	1.04
15	16:46:07.789	1.12

The experiment was conducted by passing water at varying speeds, from the slowest to the fastest, through the tap to ensure a constant and non-fluctuating flow rate. The results showed that the shorter the water flow passing through the sensor, the larger the output value. With each 47-millisecond time difference, the output of pulses generated by the rotating wheel also increased by 7. The highest value was obtained at a rapid flow condition of 4.39 L/minute. This value will be used as input for the fuzzy logic method to form the membership of a fuzzy set under the variable flow.

3.2.3. Testing of the DS18B20 Temperature Sensor

Sensor testing DS18B20 is used to determine if the sensor has worked properly as shown in Table 6. Therefore, the output value is compared with the actual temperature at the measurement time.

Table 6. Testing DS18B20 Temperature Sensor

No.	Time	Condition	Output (˚C)	Error (%)
1	13:25:10	Daylight Outdoor 34˚C	34.25	0.73
2	13:25:15		34.25	0.73
3	13:25:20		34.31	0.91
4	13:25:25		34.31	0.91
5	13:25:30		34.31	0.91
6	23:46:15	Night Outdoors Hari 28˚C	27.81	0.67
7	23:46:20		27.87	0.46
8	23:46:25		27.94	0.21
9	23:46:30		28.00	0
10	23:46:35		28.06	0.21

Tests were conducted with a time lag when sampling data of 5 seconds. The first test was conducted outdoors during the day, where the weather application showed that the area was 34°C, and the sensor output showed similar values. Then, the second test was conducted outdoors at night, and the weather application showed that the test area was 28°C. The sensor output results show values with a range close to those listed in the weather application, even though they have differences in values or error presentations that are not too large. However, with this result, it is considered that the DS18B20 temperature sensor has worked properly.

3.2.4. Overall System Testing

Overall, system testing is carried out to test and evaluate the system's performance. The object of the test is oily food, namely shrimp crackers fried for further draining. Test data can be seen in Table 7.

Table 7. Overall System Testing

No	Time	RGB	Flow (L/min)	Temp	WA	Output
1	15:08:55	167	0	25.62	1.24	On
2	15:09:00	166	0.07	25.62	1.26	On
3	15:09:05	167	0.07	25.62	1.24	On
4	15:09:10	163	0	25.62	1.31	On
5	15:09:15	170	0.07	25.56	1.19	On
6	15:09:20	163	0.07	25.5	1.31	On
7	15:09:25	175	0.07	25.44	1.11	On
8	15:09:30	181	0.07	25.37	1.01	On
9	15:09:35	176	0	25.25	1.00	On
10	15:09:40	125	0	25.06	1.93	Off

Based on Table 7, changes in the RGB values of the oil colour are due to differences in the detected oil volume, causing variations in the light reflected by the oil from the LED emitted by the sensor and captured by the photodiode sensor. If the volume of drained oil increases, the RGB values should decrease, indicating a dark category in the fuzzy set of dark types. However, inconsistent declining values were observed. This is attributed to the ambient light conditions affecting the sensor readings, given the sensor's high sensitivity, as well as the movement of the sensor during the reading process.

In the oil flow, 0.07 litres/minute of oil flowing out of the oil filtration device was detected. The flat base of the oil filtration tool makes it difficult for the oil to flow into the channel, sometimes resulting in a value of 0. Changes were observed in the temperature values observed during this filtration process. The detected temperature values also decrease as the oil is deemed dry and approaching depletion. Processed data using fuzzy logic also produces accurate values compared to manual calculations. The SSR works appropriately according to the command when the oil drainer is on or off.

After this testing process, shrimp crackers that were initially oily after the frying process became drier after filtration. The following displays the differences before and after the filtration process as shown in Figure 11. Additionally, there is [25] a visualization of monitoring data on the website.

(a) **(b)**

Figure11. Comparison of Shrimp Crackers Appearance. (a) The condition before being drained. (b) The state after being drained

4. Conclusion

From testing the characteristics of the three sensors, namely the TCS3200 colour sensor, flow sensor YF-S201, and temperature sensor DS18B20, it was found that the sensor had worked well as expected, with a maximum error percentage of 0.91% on the temperature sensor. Sugeno's fuzzy logic method can be implemented into the system, as evidenced by the corresponding output compared to theoretical calculations.-The overall testing results indicate that the system has operated as planned. The SSR can control the on-off operation of the cooking oil drainer based on sensor readings and data processing using the Sugeno fuzzy logic method.This research helps to minimise the consumption of oil content in food, thereby reducing some of the problems such as , the consumption of trans fats is very harmful to health, especially in large and continuous amounts.

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