MONITORING SYSTEM DEVELOPMENT PROCESSING COCONUT FIBER (COCOFIBER) ON INTERNET OF THINGS (IoT) BASED

Ali Imron[1], Dedeng Hirawan, S.Kom., M.Kom.[2]

[1,2] Teknik Informatika-Universitas Komputer Indonesia
Jalan Dipatiukur No. 112 Bandung, Jawa Barat 40132
E-mail : aliimron056@gmail[1], dedeng@email.unikom.ac.id[2]

ABSTRACT

Coconuts has value and important role for society both in terms of economics and socio-culture. The composition of coconut is 35% coir, 28% meat, 25% water, and 12% coconuts shell. Therefore coconut fiber has the largest percentage value of coconuts. On processing, coconut fiber produces 2 product namely cocofiber (coconut fiber) and cocopeat (coconut coir powder). So, for produce cocofiber with cocopeat content < 3% must pass throug 2 stages of the filtering process carried out, because during the first filtering process by using filtering machine, it has not get clean cocofiber, so the screen process must do for further filtering process that results must need more time for produce cocofiber with clean quality or cocopeat < 3%. Then, uncontrolled use a filtering machine, because filtering machine must be using a large amount of electrical power and used continuously for a long period of time in a day and then the machines are often left out to wait for the coconut fiber to enter, so it causes the use of electricity to be out of control. Based on the results of the study, the prototype of filtering coconut fiber was made with an automation and control system in controlling filtering machines and filtering monitoring systems. This study uses the prototype method wit black box testing for web applications. This tool can be developed into a tool on a larger scale (industry).

Keywords : Coconuts, Coconut Fiber, Cocofiber & Cocopeat, Filtering, Prototype

1. INTRODUCTION

1.1 Background of The Problem

Based on interviews with Mr. Andri Setiawan as Company Manager CV. Pamarican Agro Industry in Neglasari, Pamarican, Ciamis Regency, West Java. In a day the company processes around 40 thousand coconuts, which produces 4 tons of dry cocofiber with a number of packing of around 36 balls with a capacity of replacing 150 kg. In the screening process there are two stages: using a filtering machine and using a screen. The two stages have the same goal, namely to separate the cocopeat from the cocofiber, to produce pure or clean cocofiber. On the filtering machine that is driven by a motor with a rotation speed of 500 rpm and a slope of 40 degrees the engine is carried out after the decomposition process, where the cocopeat content attached to the cocofiber is still a lot. Then the results of the filtering machine go into the screen process to be filtered again by the craftsmen to produce a cocofiber with a cocopeat content of <3%.

So, to produce a cocofiber with a cocopeat content of <3%, it has to go through two stages of the screening process that is carried out, namely a machine filtration process and a screening process, which results in taking longer to produce a cocofiber with clean quality or <3% cocopeat. Then the uncontrolled use of filtering machines, because the filtering machine uses a considerable amount of power and is used continuously in a day and the engine is often left lit to wait for input of coconut fiber, causing the electricity to be poorly managed.

Based on this background, a coconut fiber filter prototype was made with an automation and control system in controlling the filtering machine and monitoring system resulting from filtering. Microcontroller as the main component and sensor as an input measuring instrument which is processed into information displayed on WEB-based media interfaces.

1.2 Gold and Purpose

The purpose of the research is Development of Monitoring System for Coconut Fiber Fiber (Cocofiber) based on IoT is to monitor the filtering results of cocofiber and cocopeat using an automation system on the filtering machine. The objectives of this study are:

1. Memudahkan pengrajin dalam memonitor hasil penyaringan sabut kelapa agar menghasilkan cocofiber yang bersih atau cocopeat < 3%.
2. Helps in controlling the use of the machine during the screening process.

2. THE CONTENT OF RESEARCH

2.1 Coconut

Coconut fruit has several components, namely coconut fiber, coconut shell, coconut meat and coconut water. Examples of Coconut Coir as a result of sampling from coconuts can also be processed into various products whose value is not inferior.

The types of products produced from the fiber processing industry can be grouped into two, namely cocofiber and cocopeat. [1]

2.1.1 Cocofiber

Cocofiber is a product made from coconut fiber into a fiber and one of the products with a high selling value, because it can be a product such as brooms, doormats, pillows, car / airplane seats, dashboards and so on.

2.1.2 Cocopeat

Cocopeat is a coconut fiber powder that is filtered by cocofiber which is used for hydroponic planting media which includes organic media because it is made from natural ingredients, namely coir and coconut shell. Cocopeat is one of the Coconut Coir products (coconut planting media) that is popular in Indonesia.

2.2 Monitoring System

The system is a collection or set of elements, components, or variables that are organized, interacting that are closely related to one another. [2]

2.3 Internet Of Things

According to Chui's analysis (2013), internet of things is a technology for integrating components such as machines, tools and other physical objects with an actuator network sensor to receive, send and process data, so that the machine / tool to connect and act on new information independently. [3]

2.4 Analysis of The Running System

The analysis to provide a description of the current system, aims to provide more detailed details on how the system works.

The screening procedure that takes place as follows.

1. The craftsmen will put the coconut fiber into the filtering machine.
2. The machine will spin to do the screening process.
3. The results of the screening process will produce cocofiber and cocopeat.
4. If the cocofiber will enter the screen for cleaning process to the next stage.
5. The Cocofiber goes into the screen to be sorted again.
6. Get clean cocofiber.

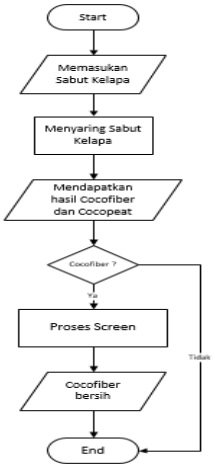

Figure 1. Running Business Processes

2.5 System Architecture To be Built

The system analysis of the construction of IoT-based coconut fiber processing monitoring system is a process to describe the system components to be built.

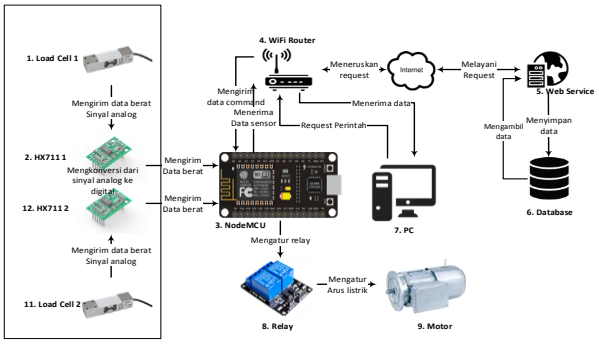

Figure 2. System Architecture

The explanation of the architecture of coconut husk filtering systems is that craftsmen can control the use of filtering machines and can see filtering results such as cocofiber weight, cocopeat weight and cocopeat content in the cocofiber. The load cell sensor aims to weigh the cocofiber and cocopeat, while the relay is used to regulate the electric current on the motor.

1. Stage from the IoT Side
   a. NodeMCU used as a microcontroller to extract data from a load cell sensor and send commands via a WiFi network to run the motor and set the On / Off to the relay.
   b. The data obtained will be processed through the available WiFi network which will be continued to the web service via the internet network.
   c. The Web Service will save the filtered data
2. Stage of The User Side
   a. Craftsmen enter the system through a browser that is connected to the internet network.
   b. Craftsmen can control the use of filtering machines and can view filtering data in the system.
   c. Request will be sent via NodeMCU and Web Service via the internet network.
   d. The web service sends the required data from the database to craftsmen with an interface on the system.
3. Stage from The Hardware Side
   a. Sensor Load Cell
      In this system the load cell sensor is used to weigh the weight of the cocofiber and cocopeat. The red cable is the sensor input voltage, the black cable is the sensor ground input, the green cable is the positive output sensor and the white cable is the sensor ground output.
   b. HX711
      This system is used as a module from a load cell sensor to convert from an analog signal to a digital signal.
   c. NodeMCU

This system is used as a microcontroller to control the performance of other components.

d. Motorcycle

In this system the motor is used to drive the filtering machine.

e. Relay

In this system the relay is used to connect and disconnect the electric current to the motor.

2.6 Communication Analysis Device

Communication analysis is communication to connect between components with one another.

.2.6.1 Communication NodeMCU and Load Cell

NodeMCU communicate with sensor load cell via pin D3, D4, D5, D6, VCC (3V or 5V), GND, DT, SCK, (E+), (E-), (A-) and (A+), can be seen in the picture below.

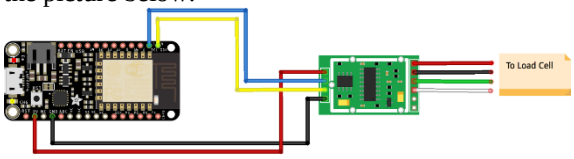

Figure 3. Communication NodeMCU and Load Cell

2.6.2 Communication NodeMcu, Relay and Motor

Communication NodeMCU with Relay through pin D8, GND, VCC (3V or 5V) and communication Relay with Motor via NO and COM, can be seen in the following figure.

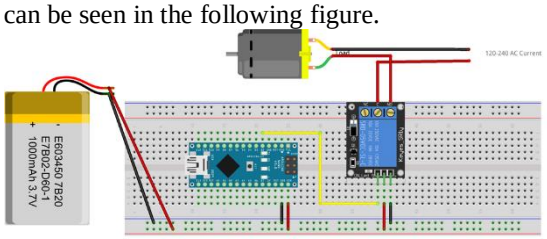

Figure 4. Communication NodeMCU, Relay and Motor

2.7 Use Case Diagram

Use Case that is to describe the system functionality from the user's view and how the system interacts with the environment. Use Case diagram can be seen as follows. [4]

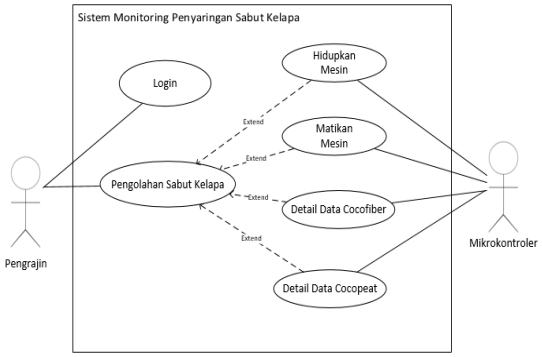

Figure 5. Use Case Diagram

2.8 Interface Design

The interface design is a description of the layout of the system interface that will be created. The interface design is done to describe in more detail the display design and menu navigation contained in it. The following is the design of this system interface.

1. Login Page

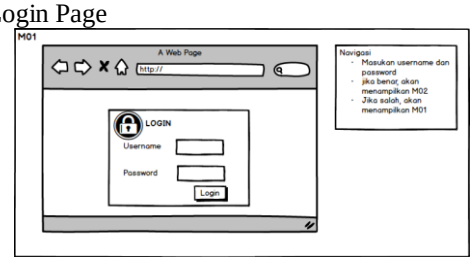

Figure 6. Login Page

2. Coconut Fiber Processing Menun Page

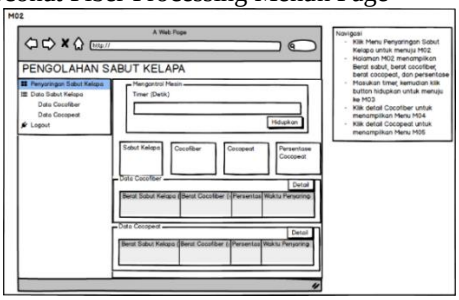

Figure 7. Coconut Fiber Processing Interface

3. Page Turn Off the Machine

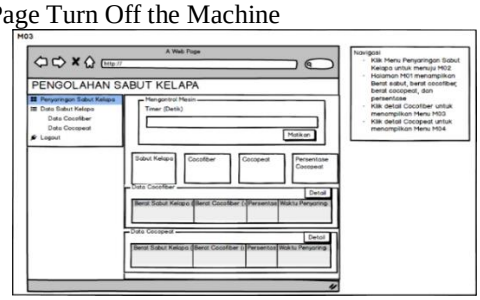

Figure 8. Interface Turn of the Machine

4. Cocofiber Weight Data Page

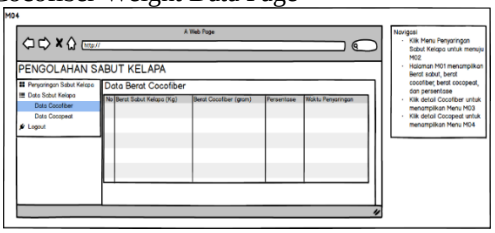

Figure 9. Interface Cocofiber Weight Data Page

5. Cocopeat Weight Data Page

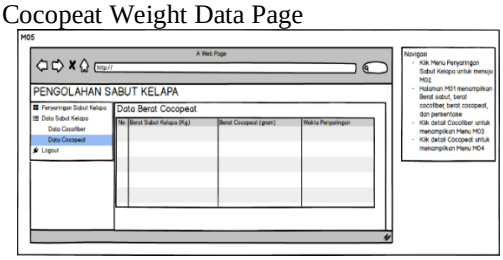

Figure 10. Interface Cocopeat Weight Data Page

2.9 Semantic Network

Semantic network is a description of the relationship of menu navigation from one page to another.

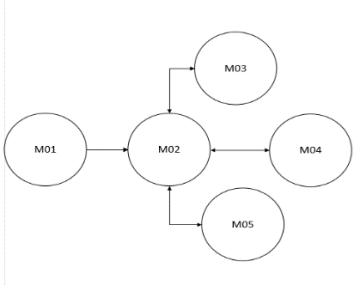

Figure 11. Semantic Network

2.10 The Hardware Implementation

The tools used in building IoT-based Coconut Fiber Processing (Cocofiber) Monitoring Systems are as follows:

Table 1. The Hardware Implementation

No	Hardware	Type
1	Mikrokontroler	NodeMCU
2	Sensor Load Cell	5 Kg dan 5 Kg
3	Modul WiFi	ESP8266
4	Relay	Relay 2 Channel
5	Modul Timbangan	HX711 Dual Channel
6	Kabel Jumper	Dupont male dan female
7	Motor AC	220 V/ 2.6 A

2.11 Hardware Testing

To find out whether the equipment is running according to the initial design, a hardware test is required. Tests are carried out on Load Cell (5 kg) and Load Cell (5 kg) sensors, relay modules and the overall work of the equipment that has been built.

a. Calibration Testing Sensor Load Cell

Calibration is the analysis process of checking the accuracy of the tool / sensor with a measurement standard. Calibration is needed to ensure that the measurement results are accurate and consistent. Next is the Load Cell sensor used in this study.

1. Load Cell 1 (5 Kg)

This Load Cell is used to weigh the weight of coconut fiber that you want to process in the filtering machine.

Figure 12. Load Cell 1 (5Kg)

The following is the result of a 5 kg load cell calibration test in the table below.

Table 2. Calibration Load Cell 1 (5Kg)

Trial	Digital Scales	Load Cell 5 kg	heavy Difference
1	200 gr	201 gr	0.005
2	181 gr	185 gr	0.022
3	144 gr	146 gr	0.014
4	65 gr	66 gr	0.015
5	51 gr	51 gr	0
6	27 gr	29 gr	0.069
7	20 gr	22 gr	0.09
8	15 gr	15r	0

2. Load Cell 2 (5Kg)

Load Cell ini digunakan untuk menimbang berat *Cocopeat* dari hasil penyaringan sabut kelapa.

Figure 13. Load Cell 2 (5Kg)

The following is the result of the load cell 2 calibration test (5kg) in the table below.

Table 3. Calibration Load Cell 2 (5 Kg)

Trial	Digital Scales	Load Cell 5 Kg	Heavy Difference
1	772 gr	762 gr	0.013
2	200 gr	199 gr	0.005
3	90 gr	90 gr	0
4	65 gr	65 gr	0
5	62 gr	62 gr	0
6	37 gr	37 gr	0
7	27 gr	27 gr	0
8	20 gr	20 gr	0

The conclusion of testing on the Load Cell 1 (5 Kg) sensor is that the load cell can weigh the load input on the scales, but in terms of the scales results

are not accurate or the value is inconsistent and there is an error, due to the lack of electricity generated by the microcontroller.

Whereas for Load Cell 2 (5 Kg) testing, the results are quite accurate, but in the 1st and 2nd tests when the load is getting heavier the results are less accurate, because they are not in accordance with the standard results of the existing scales.

c. Testing Relay Module

Relay is in charge of disconnecting and connecting electrical current as well as the function of the switch. In this case the HIGH value will be given to turn on and the LOW value to turn off. The initial state of the relay is LOW, which is dead or disconnects. [5] Here the relay functions to connect and disconnect the electric current at the motor or dynamo. Relay will work by waiting for instructions given by the user through the application by entering the desired time or duration.

The conclusion of testing of relay modules that have been done is that the relay module can function properly and work in accordance with the instructions made.

d. Filtering Machine Testing

Filtering or sorting machine functions to separate between cocofiber and cocopeat.

Figure 14. Filtering Machine

The conclusion of this test is that the engine is functioning properly, can filter and separate cocofiber and cocopeat. However, the results are not good, because the machine is small (prototype) so filtering becomes less optimal, so it must do more than one filtering for optimal results.

2.12 Overall System Testing

The whole system testing is intended to test the work of sensors and actuators that have been integrated with the web as controls. The web is used to input the required parameters and the interface that provides monitoring facilities.

Figure 15. System Filtering Machine Testing

a. Internet Connection Testing

Testing internet connection is done to test the response of instructions to the device, whether there will be a significant delay when the device is operated if the internet connection is not good or unstable.

Table 4. Connection Internet Testing

Trial	Connection Internet (signal)	Start Time	Time to move	Delay (second)
1	Very Good	06:58:00	06:58:00	0.1
2	Very Good	07:02:00	07:02:00	0.2
3	Very Good	07:10:00	07:10:00	0.2
4	Good	07:20:00	07:20:02	2
5	Good	07:23:00	07:23:01	1.5
6	Good	07:25:00	07:25:03	3
7	Bad	07:40:00	-	Not responding
8	Bad	07:43:00	-	Not responding
9	Bad	07:45:00	-	Not responding

Internet Network Information :

- Very Good = 3G (Full Bar Signal)
- Good = 3G (2-3 Bar Signal)
- Bad = 3G (1-2 Bar Signal)

The conclusion of this test is that internet network conditions greatly affect the work of this tool. Delay The tool will be porous or late

responding when the network is good enough (2-3 Bar signals) and the device does not respond if the network is running poorly, even though the time has been input.

b. Turn On Machine Testing

Engine Turning Testing is a test that is carried out to determine the timeliness that has been set from the start time to the actual time until the time is complete. Time input is done through antamuka in the web system. The test results can be seen in the following table.

Table 5. Turn On Testing

Trial	Conditions	Actual Time Starts	Input Time	Time to Move	Conditions
1	Turn On machine	07:50:00	5 Second	07:50:06	Turn On Machine
2	Turn on Machine	07:55:00	10 Second	07:55:12	Turn On Machine
3	Turn on Machine	08:00:00	15 asecond	08:00:16	Turn On Machine

From the results of the above tests it can be concluded that the system can regulate the tool from moving to stop forcibly even though there is a delay of 1-2 seconds before the tool responds.

c. Testing Data Transmission from Tool to Server

This test is carried out to find out whether the system successfully connects to the server, stores and displays on the web application data weight of cocofiber, cocopeat and displays on the coconut fiber processing menu that has been done.

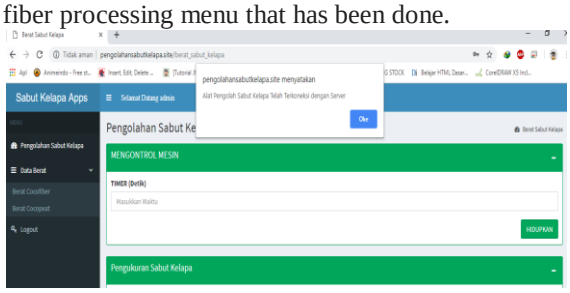

Figure 16. Testing Data Transmition from Tool to Server

The following is the test of sending data to the load cell sensor 1 (coconut fiber weight).

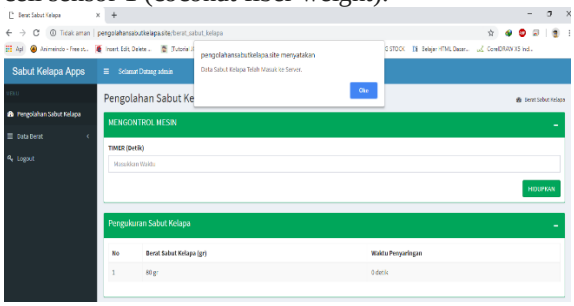

Figure 17. Testing of Data Delivery of Coconut Fiber Weight

Following is the test of sending data to the Heavy Cocofiber and Cocopeat Weight database.

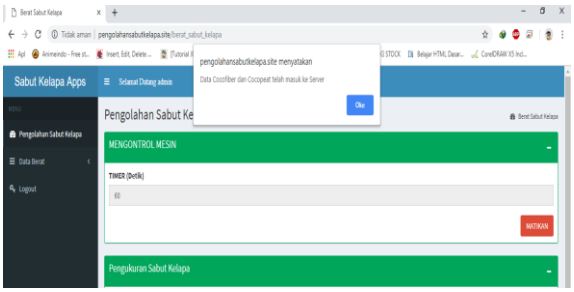

Figure 18. Cocofiber and Cocopeat Heavy Data Delivery

d. Screening Test Results

This test was conducted to find out whether the system managed to process coconut fiber and display on the cocofiber and cocopeat menu. The test results can be seen in the following picture of Cocopeat weight data.

Table 6. Cocopeat Coconut Fiber Screening Test Results

No	Coconut Fiber (gr)	Cocopeat Weight (gr)	Filtering Time (Seconds)
1	70	20	30
2	80	20	60
3	90	20	60
4	90	50	60
5	90	40	60
6	60	20	60
7	60	20	60
8	70	20	60
9	60	10	60
10	70	10	60
11	100	20	60
12	70	10	60
13	130	40	90
14	90	20	60

The following is a data table from the filtering process (Cocofiber).

Table 7. Cocofiber Coconut Fiber Screening Test Results

No	Coconut Fiber (gr)	Cocofiber Weight (gr)	Filtering Time (Seconds)	Persentase (%)
1	70	48.5	30	98
2	80	58.2	60	98
3	90	67.9	60	98
4	90	38.8	60	99
5	90	48.5	60	98
6	60	38.8	60	98
7	60	38.8	60	98
8	70	48.8	60	98
9	60	48.8	60	98
10	70	48.8	60	84

11	100	77.6	60	98
12	70	58.2	60	97
13	130	87.3	90	98
14	90	67.9	60	98

Following calculation :

Looking for a Cocofiber :

- Coconut Fiber – Cocopeat = Cocofiber
- Cocofiber * 0.03 = Remaining Cocopeat
- Cocofiber – Remaining Cocopeat = Cocofiber Clean

search for percentages

- Persentase Cocopeat = (Cocopeat / Coconut fiber) * 100
- Persentase Cocofiber = (Cocofiber / Coconut fiber) * 100
- Persentase = Persentase Cocopeat + Persentase Cocofiber

Examples of Finding a Cocofiber :

- 60 gr Coconut fiber – 20 gr Cocopeat = 40 gr Cocofiber
- 40 gr Cocofiber * 0.03 = 1.2 gr Remaining Cocopeat
- 40 gr Cocofiber – 1.2 gr Remaining Cocopeat = 38.8 gr Cocofiber Clean

Examples of Finding the Percentage of Coconut Fiber:

- Persentase Cocopeat = (20 / 60) * 100 = 33 %
- Persentase Cocofiber = (40 / 60) * 100 = 67 %
- Persentase = 33 + 67 = 100 %

So the final results obtained are 60 gr coconut fiber, 38.8 gr clean cocofiber, 20 gr cocopeat and coconut fiber percentage 98%. In conclusion, the system can display clean cocofiber results <3% cocopeat, but for the percentage of coconut fiber there is still an error of about 2% and the results of cocopeat and coconut coir scales are inconsistent. Because the sensor load cell still has not produced a consistent number where the number of scales is always changing which is influenced by the ups and downs of electricity which are channeled to the load cell sensor and the microcontroller.

3. CLOSING

3.1 Conclusion

Conclusions from the results of research, analysis, system design, and implementation, conclusions can be taken as follows:

1. In terms of functional, this tool works well and can measure the percentage of cocopeat <3%, but due to the inaccurate results of the sensor scales caused by inconsistencies in voltage, the results obtained are inconsistent or often change.
2. There is a time delay and error in the application if the internet network connection that is used is not good, so the response from the engine control is hampered.

3.2 Advice

Construction of a Coconut Fiber Fiber Monitoring System (Cocofiber) Based on the Internet of Things there are still many shortcomings. Therefore it is necessary to develop and improve further.

1. It is expected to be able to measure the filtration results to obtain a cocopeate content of <3% using tools, to minimize a process and accelerate the processing of coconut fiber.
2. Can minimize the occurrence of delays and errors when the device is operated by using a poor internet network.
3. Can improve the accuracy of the scales so that the values obtained are more accurate.
4. It is expected to be able to add one load cell sensor to the cocofiber so that the calculation becomes more accurate.

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