SITEKIN: Jurnal Sains Teknologi dan Industri, Vol. 20, No. 2, June 2023, pp.792 – 799
ISSN 2407-0939 print/ISSN 2721-2041 online

Design and Build a Grinder, Sieving, and semi Automatic Coriander Weigher

Marsha Guslita[1], Nina Paramytha[2]
[1.2] Department of Civil Engineering, Faculty of Science and Technology, Universitas Bina Darma
Jl. Jenderal Ahmad Yani No.3, 9/10 Ulu, Seberang Ulu I District, Palembang City
Email: marshaguslita17@gmail.com

ABSTRACT

There are so many spices in Indonesia with a variety of ones, one of which is coriander. Coriander is necessary in the kitchen and in the world of health, one of Indonesia's most widely used spices. There are two types, namely coarse coriander and powdered/fine coriander. Coriander grinding, sieving, and weighing tools are expected to make it easier for small industries to produce powdered/fine coriander more efficiently and well so that it can affect the pace of economic development. This study aims to discover how to make grinding, sieving, and weighing tools and how they work—assisting small industries in the production of powdered/fine coriander more efficiently and nicely. The measurement results on this tool have good values so that the device can work properly and accordingly. The grinding to weighing process has a different period according to the desired weight. 1 gram can take time from the range of 20-40 seconds

Keywords: *Design and Build Tools***,** *Semiautomatic tools***,** *ESP32 microcontrollers, load cell sensors*

Introduction

There are so many spices in Indonesia with a variety of ones, one of which is coriander. Coriander is necessary in the kitchen and in the world of health, one of Indonesia's most widely used spices. There are two types, namely coarse coriander and powdered/fine coriander. In small businesses, powdered/fine coriander production is generally done manually [1].

The journal "Design and Build a Chili Grinder and Dryer Using ATMEGA 328" in 2021 by [2][3] uses an Arduino uno atmega 328 microcontroller and a thermocouple sensor. Then the journal "Design an Electronic Balance Using a Load Cell Sensor on a Dry Turmeric Grinding Machine" in 2019 by [4][5][5] uses Arduino Mega 2560 and a load cell sensor. Based on these two journals, the author wants to make another innovation titled "Design a Semiautomatic Coriander Grinder, Sift, and Weigler" using the ESP32 microcontroller and load cell sensor [6]. Milling, sieving, and weighing tools are expected to make it easier for small industries to produce powdered/fine coriander more efficiently and well so that it can affect the pace of economic development[7][8][8]. This study aims to find out how to make grinding, sieving, and weighing tools and how they work—assisting small industries in the production of powdered/fine coriander more efficiently and nicely.

Research Methods

Hardware Planning

Hardware Planning is a tool that begins with creating a block diagram of the overall design[9]. This planning includes selecting components to be used, creating a series of schematics and component layouts, installing components and the last stage, namely finishing[10].

Designing Tools

In the design stage, the tool aims to run well according to the expected end until the device can be used ideally as desired [11]. What is being done now is to create a tool design that aims to determine the layout of components so that components can be installed correctly and regularly. Furthermore, to create a plan and build this tool, a flow chart is needed[12][13][13]. This flow chart aims to design the step-by-step process of this tool to produce the desired results. The flow chart is shown in figure 1.

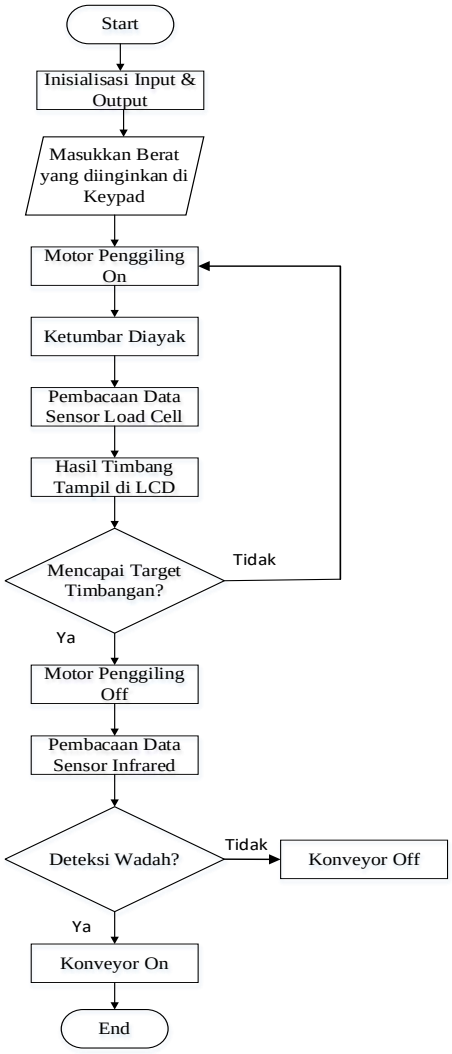

Figure 1 Flowchart Tool

How the Tool Works

The grinder, sieving, and coriander weighing tool uses the ESP32 microcontroller, load cell sensor, 16x2 LCD, two-channel relay module, servo, AC motor, conveyor, infrared and push button. The primary source is to use the power supply. The way the tool works is that when connected to the electricity, it will enter the tool's power supply [14]. Enter the number as the desired weight amount, and press D□A then grind on. The ground coriander will be directly sifted and headed to weighing [15]. If the weight of the coriander has reached its target eating the grinding will stop. Then the servo will open for 5 seconds, and the cilantro will be sifted into the container. Infrared one will read the container for 5 seconds, and then the conveyor is on. When the container is detected in infrared two, then the conveyor is off.

Installation of the Relay Module to the ESP32 Microcontroller

In this process, a relay module to the ESP32 micrycontroller is installed, which functions to control the voltage here using 3.3 V on the ESP32 microcontroller [16].

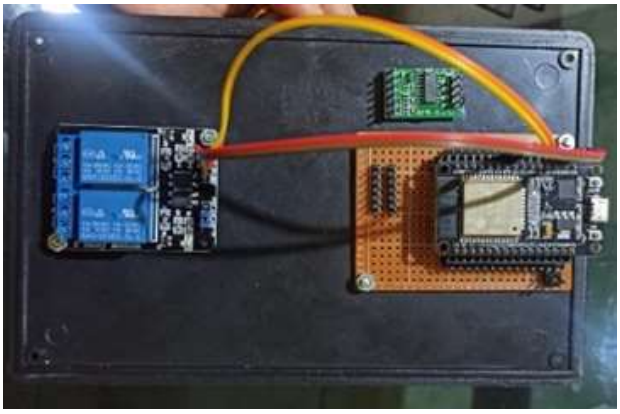

Figure 2. Installation of the Relay Module to the ESP32 Microcontroller

Mounting the Load Cell to the ESP32 Microcontroller
In this process, the installation of the load cell to the ESP32 microcontroller, which functions to regulate the load cell sensor [17].

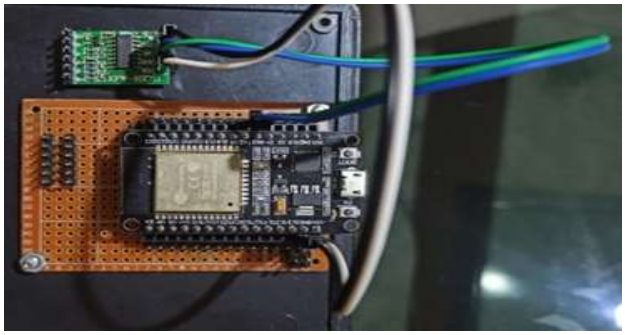

Figure 3. Mounting the Load Cell to the ESP32 Microcontroller

LCD Mounting to the ESP32 Microcontroller
In this process, an LCD is attached to the ESP32 microcontroller, which displays the results of coriander scales [18].

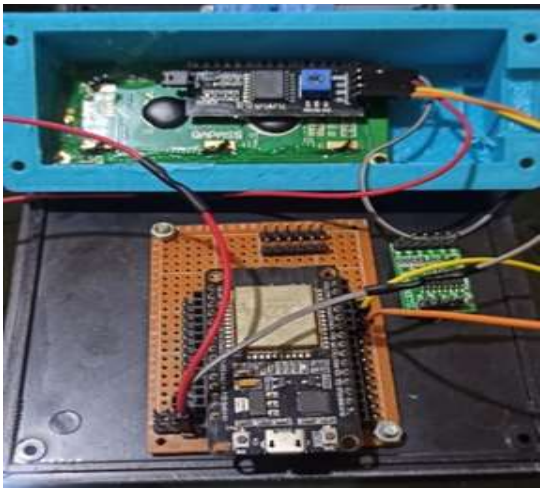

Figure 4 Mounting the LCD to the ESP32 Microcontroller

Load Cell Installation
This load cell reads the weight of coriander loads that have gone through the grinding and sifting process[19].

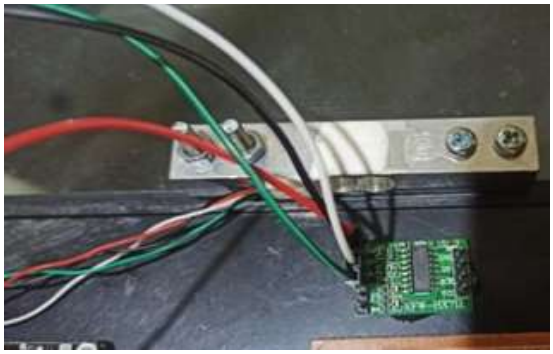

Figure 5 Load Cell Mounting

Tool Workmanship
Here is the overall process of some of the components and tools created and installed.

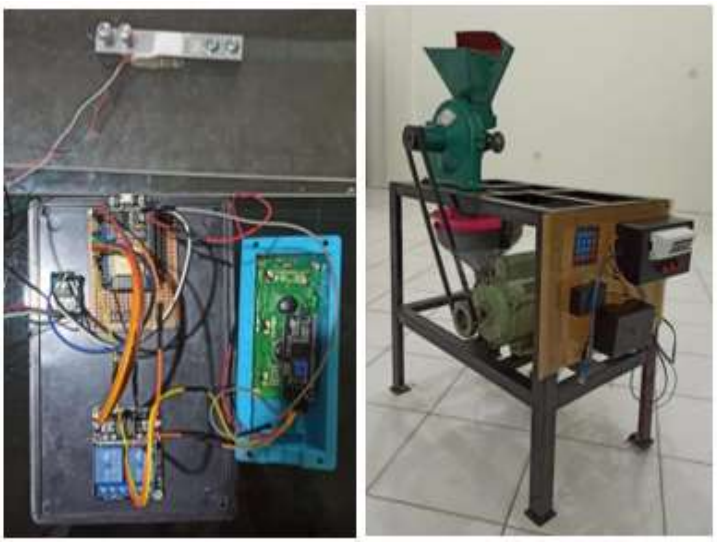

Figure 6 Tool Work Progress

Results and Discussion

Measurement
The results of measurements are carried out at 11 measurement points, where each point is carried out five times the size. Therefore from the five measurement results, the average value will be taken.

Table 1 Measurement Results

Measurement Position	Measurement Points		Many Measurements					Average Value	Ketmoans
			1	2	3	4	5		
Power Supply	TP1	V_{ac}	220	221	222	220	220	220,6	Input Power supply from
Transformer	TP2	V_{ac}	12	12,1	12	12,1	12	12,04	Bridge diode input

Diode	TP3	V_{dc}	12,65	12,66	12,65	12,66	12,65	12,654	Diode output before the capacitor
		Ma	0,16	00.15	00.16	0,16	00.15	0,16	Current at Diode Output
Capacitor	TP4	V_{dc}	12,69	12,68	12,67	12,69	12,68	12,682	Capacitor output, input IC 7805
		Ma	0,17	0,16	0,16	0,16	0,15	0,16	Input IC 7805
IC Voltage	TP5	V_{dc}	4,98	4,97	4,96	4,98	4,98	4,974	LCD Input, ESP32, Load Cell, Infrared, Servo, 2 Channel Relay, Keypad
Keypad	TP6	V_{dc}	4,95	4,95	4,94	4,95	4,95	4,948	IC 7805 output
LCD	TP7	V_{dc}	4,95	4,95	4,95	4,95	4,94	4,948	LCD Input/Output IC 7805
Servo	TP8	V_{dc}	4,95	4,95	4,94	4,95	4,95	4,948	Servo Input/IC Output 7805
Relay 2 Channel	TP9	V_{dc}	4,95	4,95	4,94	4,95	4,95	4,948	Input Relay 2 Channel/Output IC 7805
Load Cell	TP10	V_{dc}	4,95	4,95	4,95	4,95	4,94	4,948	Input Load Cell/Output IC 7805
Infrared	TP11	V_{dc}	4,95	4,96	4,94	4,94	4,96	4,95	Infrared Input/Output IC 7805
ESP32	TP12	V_{dc}	4,95	4,95	4,94	4,95	4,95	4,948	Input infrared/Output IC 7805

Error Percentage Calculation

To find out what percentage of the error in this tool clash, you can use the error formula, namely:

$$\%\text{Error} = \text{x } 100\% \ \frac{\text{Measurement Value} - \text{Exact Value}}{\text{Exact Value}}$$

$= x\ 100\% \frac{12.04-12}{12}$
$= 0.003\%$

Here are the results of the error calculation based on *the datasheet* and the measurements shown in Table 2:

Table 2 Error Calculation Results

Measurement Location	Measurement Points	Datasheet (V)	Measurement	Calculation (%)	Ket
Power Supply	TP1	220	220,6	0,6	Good
Transformer	TP2	12	12,04	0,003	Good
Diode	TP3	12	12,654	0,05	Good
Capacitor	TP4	12	12,682	0,05	Good
IC Voltage	TP5	5	4,974	0,06	Good
Keypad	TP6	5	4,948	0,01	Good
LCD	TP7	5	4,948	0,01	Good
Servo	TP8	5	4,948	0,01	Good
Relay 2 Channel	TP9	5	4,948	0,01	Good
Load Cell	TP10	5	4,948	0,01	Good
Infrared	TP11	5	4,95	0,01	Good
ESP32	TP12	5	4,948	0,01	Good

Tool Testing Results
In this experiment, coriander milling was tested five times with a weight of 1 gram, 2 grams, 3 grams, 4 grams, and 5 grams. This test, it will be compared between the load cell sensor and the digital scale. Here is a comparison table of the test tools shown in table 3.

Table 3 Weight Comparison of Load Cells and Digital Scales

Load Cell (Grams)	Digital Scales (Grams)	Difference (Grams)	Time (s)
1	0,7	0,3	20-40
2	1,65	0,35	25-40
3	2,75	0,25	30-45
4	3,64	0,36	35-50
5	4,58	0,42	40-60

Here is a table of weight displays on the LCD, and the results of coriander grinding are shown in table 4.

Weight (grams)	LCD Display	Grinding Results
1		

2		
3		
4		
5		

Analysts

From the testing and training that has been carried out, it can be analyzed as follows[20]–[25]t:

1. The measurement results on this tool have good values so that the device can work properly and accordingly.
2. The grinding to weighing process has a different period according to the desired weight. One gram can take time from the range of 20-40 seconds.
3. The table of measurement and calculation results has a low percentage of error.
4. The difference between the load cell sensor and the digital scale can be caused by the vibration that occurs when the motor is on, which results in the pulse of the load cell sensor reading the weight.

Conclusion

Milling, sifting and weighing work well, as evidenced by the results of measurements and calculations whose values are still in the values corresponding to the datasheet and are evidenced by standard error percentages so that all components work with the trough. The period from grinding to weighing depends on how heavy the cilantro is inputted into the keypad. The heavier the weighing, the longer the grinding process.

References

[1] P. Oyarzun, "A Proteome-Wide Immunoinformatics Tool to Accelerate T-Cell Epitope Discovery and Vaccine Design in the Context of Emerging Infectious Diseases: An Ethnicity-Oriented Approach," *Front. Immunol.*, vol. 12, 2021, doi: 10.3389/fimmu.2021.598778.

[2] V. C. Guntara, "RANCANG BANGUN ALAT PENGGILING DAN PENGERING CABAI MENGGUNAKAN ATMEGA 328," *J. Energy Electr. Eng.*, vol. 3, no. 1, 2021.

[3] C. Visvikis, "Assessing lap belt path and submarining risk in booster seats: Abdominal pressure twin sensors vs. anterior-superior iliac spine load cells," *Conference proceedings International Research Council on the Biomechanics of Injury, IRCOBI*, vol. 2018. pp. 655–668, 2018. [Online]. Available: https://api.elsevier.com/content/abstract/scopus_id/85061076980

[4] I. Ishaq, A. Azhar, and M. Muhaimin, "RANCANG BANGUN NERACA ELEKTRONIK MENGGUNAKAN SENSOR LOAD CELL PADA MESIN PENGGILING KUNYIT KERING," *J. TEKTRO*, vol. 3, no. 1, 2019.

[5] R. Andok, "Concept of a MEMS load cell sensor of mechanical quantities based on the em field principle," *AIP Conference Proceedings*, vol. 1996. 2018. doi: 10.1063/1.5048854.

[6] S. W. Wang, "A continuous water-level sensor based on load cell and floating pipe," *Proceedings of 4th IEEE International Conference on Applied System Innovation 2018, ICASI 2018*. pp. 151–154, 2018. doi: 10.1109/ICASI.2018.8394554.

[7] K. Y. Joung, "3D-printed load cell using nanocarbon composite strain sensor," *Sensors*, vol. 21, no. 11, 2021, doi: 10.3390/s21113675.

[8] C. R. Cutler, "Open-source 3D printed sensors for hand strength assessment: Validation of low-cost load cell and fabric sensor-based systems," *Aust. Occup. Ther. J.*, vol. 65, no. 5, pp. 412–419, 2018, doi: 10.1111/1440-1630.12494.

[9] M. H. Mubarok, "Real-time enthalpy measurement of two-phase geothermal fluid flow using load cell sensors: Field testing results," *Geothermics*, vol. 89, 2021, doi: 10.1016/j.geothermics.2020.101930.

[10] A. F. Hastawan, "Comparison of testing load cell sensor data sampling method based on the variation of time delay," *IOP Conference Series: Earth and Environmental Science*, vol. 700, no. 1. 2021. doi: 10.1088/1755-1315/700/1/012018.

[11] N. Kumar, "Development of a Load-Cell Based Palpation Sensor Suitable for Ophthalmic Anesthesia Training," *Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBS*, vol. 2018. pp. 929–932, 2018. doi: 10.1109/EMBC.2018.8512364.

[12] T. Itoh, "Development of new sensor systems for continuous bedload monitoring using a submerged load-cell system (SLS)," *Earth Surf. Process. Landforms*, vol. 43, no. 8, pp. 1689–1700, 2018, doi: 10.1002/esp.4329.

[13] P. C. Tsai, "A robust embedded load cell sensor for tool life prognosis and smart sawing of medium carbon steel," *Int. J. Adv. Manuf. Technol.*, vol. 121, no. 1, pp. 1353–1364, 2022, doi: 10.1007/s00170-022-09377-9.

[14] Z. T. Dallal, "Fabrication and validation of respiratory control belt using load cell sensor," *Front. Biomed. Technol.*, vol. 7, no. 4, pp. 281–285, 2020, doi: 10.18502/fbt.v7i4.5325.

[15] A. N. Miftachul, "Model sistem monitoring minyak pelumas digital dengan memanfaatkan gaya apung dengan sensor load cell," *Automot. Exp.*, vol. 1, no. 1, pp. 24–29, 2018, doi: 10.31603/ae.v1i01.2019.

[16] S. Wankhar, "A versatile stretch sensor for measuring physiological movement using a centre loaded, end-supported load cell," *J. Med. Eng. Technol.*, vol. 41, no. 5, pp. 406–414, 2017, doi: 10.1080/03091902.2017.1313327.

[17] K. V Kaul, "Real-time Load Monitoring and Estimation of Waterline in Boat using Load Cell Assembly and Ultrasonic Sensor," *13th International Conference on Advances in Computing, Control, and Telecommunication Technologies, ACT 2022*, vol. 8. pp. 688–693, 2022. [Online]. Available: https://api.elsevier.com/content/abstract/scopus_id/85143326283

[18] B. Chimehi, "Load Cell Force and Direction Sensor System for Push Bars," *2022 IEEE Sensors Applications Symposium, SAS 2022 - Proceedings*. 2022. doi: 10.1109/SAS54819.2022.9881253.

[19] N. D. Arianti, "Oscillation effect dataset on the measurement accuracy of load-cell sensor applied to the weigh basket," *Data in Brief*, vol. 38. 2021. doi: 10.1016/j.dib.2021.107453.

[20] M. Goelzer, "Cells as functional load sensors and drivers of adaptation," *Mechanobiology: From Molecular Sensing to Disease*. pp. 79–98, 2019. doi: 10.1016/B978-0-12-817931-4.00005-4.

[21] F. R. Masch, "On-the-go sensor with embedded load cells for measuring soil mechanical resistance," *Cienc. del Suelo*, vol. 38, no. 1, pp. 21–28, 2020, [Online]. Available: https://api.elsevier.com/content/abstract/scopus_id/85087848153