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The Design of Automatic Powder Packaging Tools Based on Atmega 16 Microcontroller on Home industry

Koko Joni [a,1], Bagus Wahyudi [a,2,*], Riza Alfita [a,3],Miftachul Ulum [a,4]

[a] Prodi Teknik elektro, Fakultas Teknik, Universitas Trunojoyo Madura, Jl. Raya Telang, Bangkalan 69162, Indonesia.
[1] kokojoni@trunojoyo.ac.id; [2] bgswhyd67@gmail.com *; [3] riza.alfita@trunojoyo.ac.id;
[4] miftachul.ulum@trunojoyo.ac.id
[*] corresponding author

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Sealer

ABSTRACT

In the world of production, packaging is an important factor. Especially if the product is in the form of food. The function of the packaging is to protect from sunlight, dust and other damage. In the home industry, many of them still use the manual method, the process still requires a lot of human labor. For this reason, a design and construction of an automatic powder packaging device based on the Atmega 16 microcontroller was made. This tool functions to package powder (flour, sugar and coffee) which is packaged automatically using a microcontroller as the brain of the tool. The packaging method was originally put the powder in each container, then the powder will come out automatically according to the input of the powder type and the weight desired by the operator through the keypad, Then the powder goes to the dosage that Loadcell has installed as a weight detector displayed on the LCD, After the weight reaches the set point then the powder will drop into the package, the packaging that has been filled with powder will be pressed using a sealer. From the tests carried out, the percentage of success reached 70%.

1. Introduction

Packaging is an important factor in production, especially if the product is a food ingredient. This is related to the function of the packaging itself, which is to protect from the sun, dust an dother damage, making it easier to transport, market, and store [1].

Apart of being a packaging medium, packaging is also an information material for consumers who want to know our products. Because in the packaging there is a label or sticker that is made to attract consumers to see the brand and the results of who produced it. Various ways of packaging food have existed since ancient times, starting from using teak leaves, banana leaves then using paper until now using plastic, cans or metal. Along with the rapid development of today's technology, various sealer packaging machines have emerged. Among them are hand sealer, cup sealer, vacum sealer machine[2].

In general, these machines still use human labor, according to the way they work which must put the product into the packaging, then the packaging is sealed with the machine [3]. The various processes involved in packaging are neatly aligned and timed to get the optimal level of production [4].

In order to make human work easier in the packaging process, an automatic packaging machine was created, this machine is able to work automatically starting from measuring the weight of objects, putting products in packaging, to pressing the packaging[5]. The automatic machine has many advantages, for example in terms of speed of the packaging process and lightening human work [6].

2. The Proposed Method/Algorithm

2.1. Microcontroller

The Microcontroller is functions as a brain tool that integrates components and is used to carry out tasks in a program[7][8].

2.2. LCD

Serves as a data display medium in the form of characters, numbers, letters and graphics[9].

2.3. Keypad

Keypad is functions as a device to input a command between humans and lectronic devices[10].

2.4. Loadcell Sensor

A sensor that detects load weight or pressure, and is the main component of a digital weighing system[11].

2.5. Motor DC

It is a direct motor that converts the supply voltage into mechanical energy which produces motion [12].

2.6. Pneumatic

Pneumatic is a drive system that uses air pressure as its driving force [13].

2.7. Compressor

Is a machine to increase fluid pressure, namely air or gas.

2.8. Power supply

Is an electric device that supplies power to an electric load to convert the electric current from the source to the right voltage, current and frequency at the load.

3. Method

3.1. Tool Design

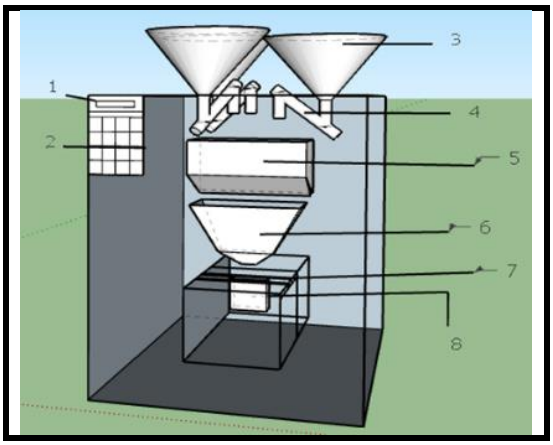

Fig. 1. Simple Tool Design

Information:

1. LCD functions as a display of the input and the output processes running on the device;
2. Keypad functions as value input to be processed on the packaging device;
3. The powder container serves as a storage place for powder before packaging processing (there are 3 tubes);
4. A pipe which a screw is installed in it to stir the powder so that it does not get stuct or clot so that the powder can go down to the scale;
5. Scale as an indicator of powder weight which is measured before the powder drops into the funnel;
6. A Funnel as a path of weighed powder to previously opened packages;
7. Plastic packaging(standing pouch);
8. Sealer as a heating element in the packaging pressing process after being filled with powder.

3.2. Circuit Design

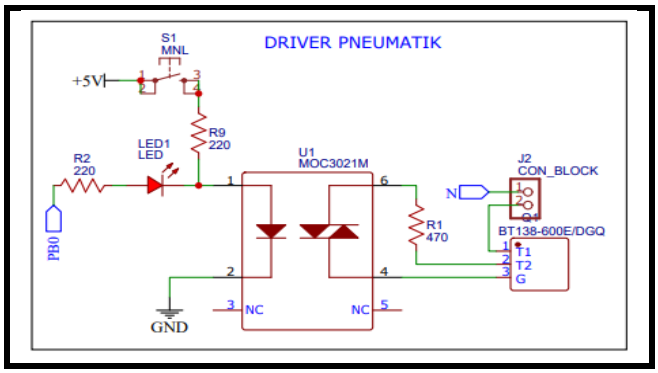

Fig. 2. Driver Pneumatic

In the series of pneumatic drivers as a regulator of the pneumatic part whose function is to drive the measuring scales on the tool through the wind generated by the compressor through the vacuum.

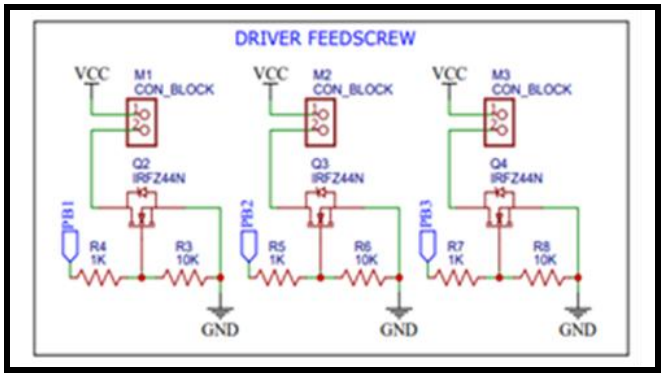

Fig. 3. Driver Feedscrew

On this feedscrew drivers circuit, it functions to assist the bottom of the container, which contains a pipe that is placed in the DC motor so that the threads can stir the powder not jammed and come out smoothly.

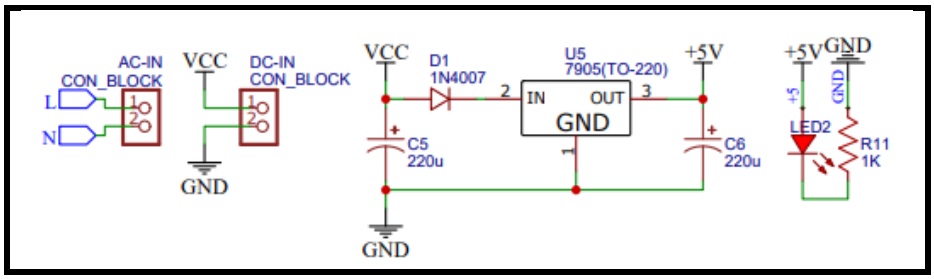

Fig. 4. Regulator Power Supply

On this circuit Regulator Power Supply functions as a voltage regulator on the appliance.

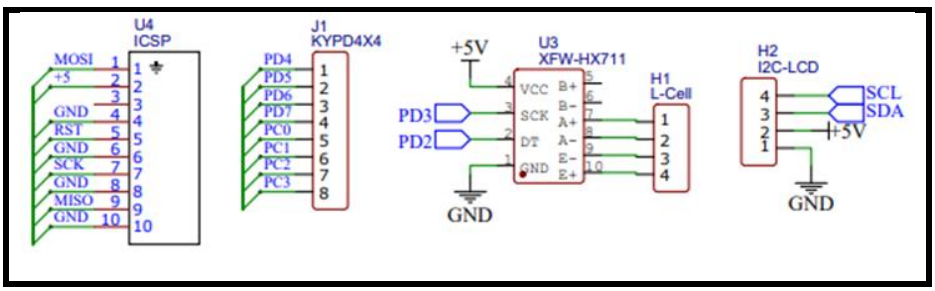

Fig. 5. Connecting Circuit For Sensors

This circuit explains the connection to the sensor used in this packaging device in the form of a load cell sensor and thel H711 module and is displayed on the LCD.

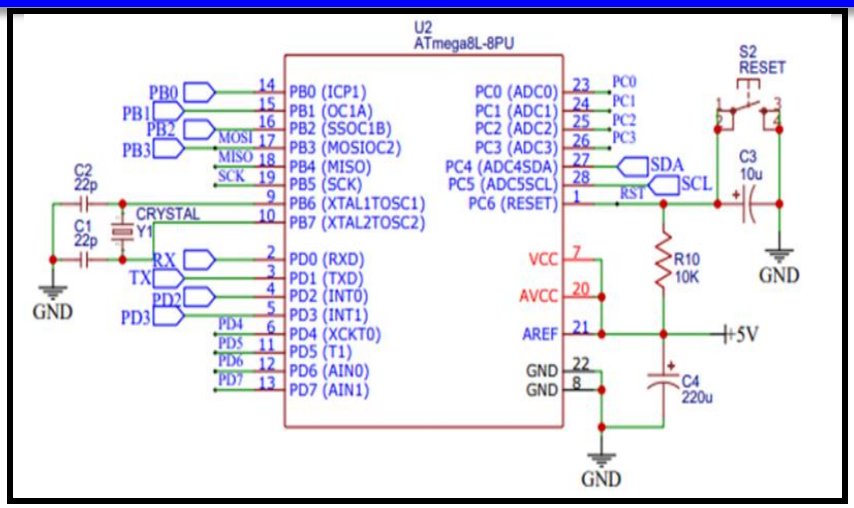

Fig. 6. Atmega 16 Microcontroller Circuit

In this Atmega 16 microcontroller circuit as a regulator or brain of all components and as a regulator of input via the keypad and output in the form of a display on the LCD.

3.3. Diagram Block

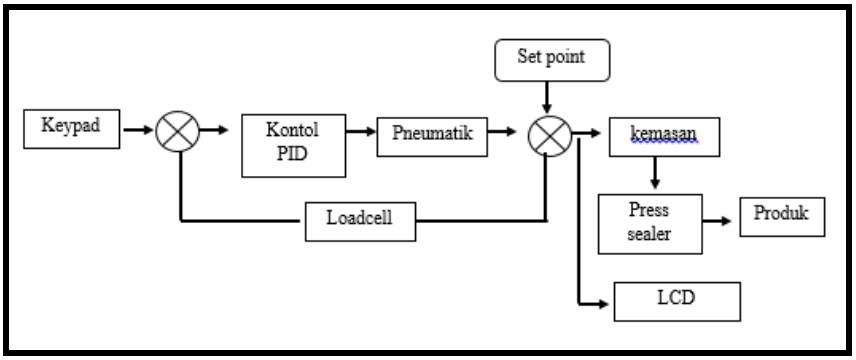

Fig. 7. Diagram block

In the block diagram above explains the input section in the form of a keypad as a command giver o the PID control which functions as a motor player that has been screwed on as a powder stirrer so that the powder can go down to the scales that have been installed by the loadcell, and when the weight of the powder reaches the set point, the pneumatics will open the cross section. So that the powder will go to the funnel and fill the package then the sealer will press the package filled with the powder. While the output is displayed on the LCD in the form of powder type and weight inputted by the operator. The final output is a packaged powder product.

4. Result and Discussions

Fig. 8. Front and Side View Tool Picture

a. Example of the test results weighing 10 grams and 20 grams for testing the minimum weight in testing tools.

Fig. 9. Loadcell weighing results on LCD and digital scale (weight 10 gram)

The difference between the loadcell weighing results for devices with digital scale is 9 gram.

Fig. 10. Loadcell Weighing Result on LCD and Digital Scales (Weight 20 Grams)

The difference in the result of load cell weighing on tools with digital scales is 6 grams.

b. Example the test results weigh 50 grams and 60 grams for medium weight testing in tool testing.

Fig. 11. Loadcell Weighing Results on LCD and Digital Scales (Weight 50 Gram)

The difference between the loadcell weighing results for devices with digital scale is 9 grams.

Fig. 12. Loadcell Weighing Results on LCD and Digital Scales (Weight 60 Grams)

The difference between the loadcell weighing results for devices with digital scales is 1 gram.

c. The example of the test results weigh 90 grams and 100 grams for testing the maximum weight of the tool testing.

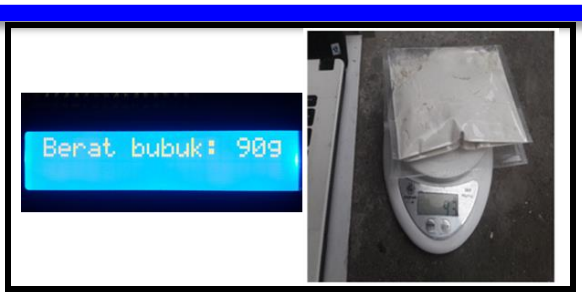

Fig. 13. Loadcell Weighing Results on LCD and Digital Scales (Weight 90 Grams)

The difference in the result of loadcell weighing on a device with a digital scale is 3 grams.

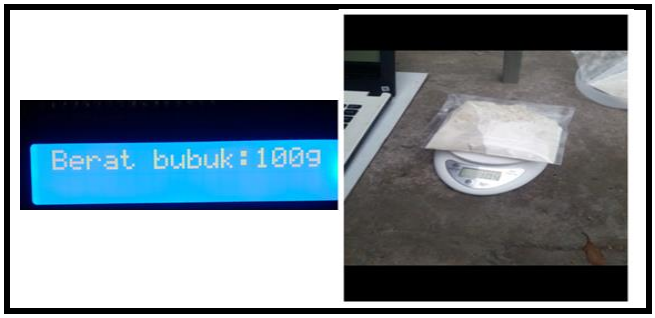

Fig. 14. Loadcell Weighing Results on LCD and Digital Scales (Weight 100 Grams)

The difference in the result of loadcell weighing on a device with digital scale is 3 grams. From 50 experiments the results obtained are in accordance with the table below:

Table. 1. Retrieval of Test Data on Powder Packaging Tools

Experiment of-	Input (gram)	Output loadcell (gram)	Output scale (gram)	Difference in weight between loadcell and scale (gram)	Description Ideal(I) or less than Ideal (KI)
1	10	10	19	9	KI
2	10	10	17	7	I
3	10	10	19	9	KI
4	10	10	17	7	I
5	10	10	17	7	I
6	20	20	26	6	KI
7	20	20	25	5	KI
8	20	20	27	7	I
9	20	20	27	7	I
10	20	20	27	7	I
11	30	30	36	6	KI
12	30	30	37	7	I
13	30	30	37	7	I
14	30	30	37	7	I
15	30	30	37	7	I
16	40	40	39	1	KI
17	40	40	47	7	I
18	40	40	47	7	I
19	40	40	47	7	I
20	40	40	46	6	KI
21	50	50	59	9	KI
22	50	50	57	7	I
23	50	50	57	7	I
24	50	50	57	7	I
25	50	50	57	7	I
26	60	60	61	1	KI

Experiment of-	Input (gram)	Output loadcell (gram)	Output scale (gram)	Difference in weight between loadcell and scale (gram)	Description Ideal(I) or less than Ideal (KI)
27	60	60	67	7	I
28	60	60	67	7	I
29	60	60	67	7	I
30	60	60	67	7	I
31	70	70	73	3	KI
32	70	70	77	7	I
33	70	70	76	6	KI
34	70	70	77	7	I
35	70	70	77	7	I
36	80	80	80	0	KI
37	80	80	87	7	I
38	80	80	88	8	KI
39	80	80	87	7	I
40	80	80	87	7	I
41	90	90	93	3	KI
42	90	90	97	7	I
43	90	90	97	7	I
44	90	90	97	7	I
45	90	90	97	7	I
46	100	100	104	4	KI
47	100	100	107	7	I
48	100	100	107	7	I
49	100	100	107	7	I
50	100	100	107	7	I

Note that the weight of the plastic packaging without powder is 7 grams.
So the powder weight experiment is declared ideal if the weight between the load cell output and the output of the scale has a difference of +7 grams (weight of the package).
If there is a weight difference of less or more than +7 grams, the powder weight experiment is considered less than ideal.
From 50 experiments, it is obtained that ideal 35 times and less than ideal 15 times
Then the percentage of success:

$$\frac{jumlah\ percobaan\ ideal}{jumlah\ data\ percoban} \times 100\% = \frac{35}{50} \times 100\%$$

$$= 3500 : 50$$

$$= 70\%$$

$$Error\ Precentage = 100\% - Precentage\ of\ Success$$

$$= 100\% : 70\%$$

$$= 30\%$$

5. Conclusions

Based on the results of the design, implementation and test results of the tools that have been made, it can be concluded that from these results t can create an automatic powder packaging device with a simple success percentage of up to 70%.

Then the weighing results are determined by the level of precision of the weight sensor. The difference in the weighing results is caused by several factors, including the vibration of the vibrator in the powder container which affects the weighing result.

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