The Analysis of Electrical Properties in Soybean Seed Variety Using Color Sensor

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***Abstract*— This research aimed to analyze the electrical properties, especially voltage of the color sensor on soybean seed variety. The kinds of soybean variety's samples are Anjasmoro, Burangrang and Sinabung. The data was collected by placing a sample of soybean under the color sensor at a distance of 2 cm. The color sensor had been connected to a voltage source of 5 Volt. Color sensor that used in this research has a frequency as an output. After that, frequency output of the color sensor would be converted to be a voltage using converter series of frequency to voltage. The reading of the color sensor output voltage in soybean variety has average about 1,96 Volt for Anjasmoro, 2,04 Volt for Burangrang, and 1,81Volt for Sinabung. This result indicated that although soybean seed looks yellow, they have a different value of the frequency and voltage output sensor.**

Keywords*— *electrical properties; soybean seed variety; color sensor

I. INTRODUCTION

Today soybeans not only used as a source of protein, but also as a functional food that can preventing the degenerative diseases such as aging, coronary heart disease and hypertency. Isoflavon compounds in soybean was found to act as antioxidants. The diversity uses of the soybean, will be improved soybean market consumption [1].

To increase domestic production of soybean need a good effort. One effort that can be done is through the use of high yielding varieties, high yielding seeds and appropriate quality for certain processed products [2]. Prediction of potential yields during crop growth season is important for successful agricultural decision-making [3]. The quality of soybeans (properly dried, no cracked or broken kernels, absence of foreign material) is important their storage and precision soybean seeding [4]. In the face of declining soybeans production in the dry season, it needs drought tolerant soybeans seeds, which can maintain soybeans production although suffered from environmental stress triggered by drought [5].

The selection of varieties is done by sorting soybean seed item by item rely on the sense of sight. Based on theory this selection process can be done because the objects can be seen by the eye as a result of light on objects, so the object would be visible to the eye with a certain color [6]. The accuracy of determining the color in industrial processes is very important for determining the quality of production [7].

Previous studies on the effect of color on the quality of the object has been done for example in fermented tea, the assessment of color quality orthodox black tea [8] as well as the identification of soybean varieties with the image processing method cluster analysis [9].

This study would conduct theoretical background and practical implementation in the field about color matching technique on soybean seed varieties using color sensors. The output of the color sensor can be seen the magnitude of the output voltage which is one form of a massive increase in electricity.

II. BACKGROUND

A. Electrical Properties

There are two physical quantities which became the basis of the electrical quantity, namely electric charge and electric energy. Charge and energy are the basic concepts of physics and become a scientific foundation in technology. In practice we are not able to process directly the magnitude of this foundation because it is not easy to measure. The electrical quantities that can be easily measured are voltage, current and power. Current can be defined as the flow of charge passing through a conductor. Current can also be defined as the average load that passes through a point in the electrical circuit. Electrical voltage related to the energy changes experienced by the charge at the time of moving from one point to another [10]. Power quantity can be measured directly or can be calculate from current and voltage.

Sensor can be converting physical quantities into electrical quantities. The conversion would be easier if the output sensor can be either current or voltage. Easy in this case relates on quantity that can be measured easily [11].

B. *Soybean Seed Variety*

Balitkabi (Balai Penelitian Kacang-kacangan dan Umbi-umbian) Malang has been releasing some soybean varieties that have diverse properties. Some varieties are Argomulyo, Anjasmoro, Burangrang, Sinabung, Kaba, Bromo, Panderman and Grobogan. Generally, these varieties have large seeds and yellow color. Soybean varieties have high potential market products. Soybean varieties can be processed into a lot of kind products [1].

To keep the soybean seed correctly, can be done through seed storage at low temperatures. The aim at low temperatures that the soybean still in a good variety [12].

C. *Color Sensor*

Sensor is a device that converts physical quantities into electrical quantities [10]. The first performed on a sensor is characterization. Characterization was conducted to determine the sensor performance. Sensor was considered as a black box which the characteristics are determined by input and output signal relations [11].

Color sensor can be converting physical quantities of light into electrical signals. The electrical signal form is wave frequency. TCS 230 color sensor works on the voltage range of 2.7 to 5.5 volts and a current range 2-7 miliAmpere. The Temperature sensor installation is at (-25) ° C - 70 ° C. This sensor can detect objects within a distance of 25 mm and saw a rectangular area with sides of 4 mm, or 64 mm 3 volume visual space [13][14].

Color sensor consists of a photodiode. A photodiode has two terminals, a cathode and an anode. It has a low forward resistance (anode positive) and high reverse resistance (anode negative). Normal biased operation of most photodiodes calls for negative biasing. The active area of the device is the anode or positive biasing. The backside of the device is the cathode [5].

Photodiode in TCS 230 arranged in an array. It will issue a photodiode current that is proportional to the light that hits the color levels. This current is then converted into a square wave output of the sensor appears on the oscilloscope screen.

The main component of TCS 230 is shown in Figure 1.

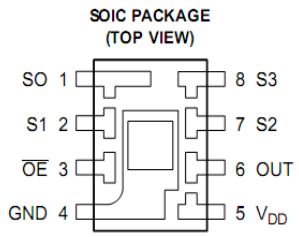

Fig. 1. Main components of TCS 230

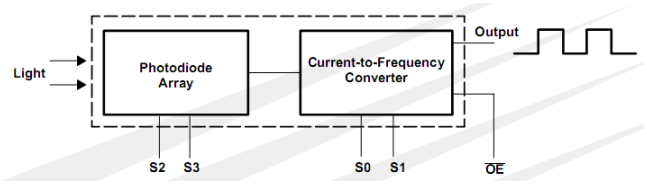

Fig. 2. Functional block diagram

The Functional Block Diagram of TCS 230 is shown in Figure 2.

III. METHOD

This study aimed to analyze the magnitude of the voltage of electricity especially soybean seed by using a color sensor. The sensor system used in this study is TCS230 color sensor with a voltage source 5 Volt.

Samples of soybean varieties obtained from Balitkabi (Balai Penelitian Kacang kacangan dan Umbi-umbian), Malang. Type of soybean varieties used as samples are Sinabung, Burangrang and Anjasmoro. 10 seeds from each sample are taken for data collections. This seed will sensored by TCS 230 and taken the data voltage.

Before data collection on soybean seed, the first thing to do is characterize the TCS230. Characterization of the sensor is done by placing a sheet of white paper under the sensor at a distance of 2 cm. This sensing of the results to be obtained sensor output frequency data.

Collecting data for soybean seeds is done by using a green filter. The treatment of the sensor is to connect a voltage of 5 volts to the foot of selectors S2 and S3, as well as the 100% output frequency scaling is to provide 5 volts to the feet of selectors S0 and S1 are all done by giving the command to the programming language by the microcontroller. Selection of the legs of the color sensor is intended to obtain a maximum output power when the TCS 230 is used to censor the skin color of soy. Pin output from the sensor is connected to the microcontroller, then microcontroller output received computer.

The output of the sensor can be directly read on the oscilloscope screen is a frequency scale. After we get the frequency output sensor for each soybean seed varieties, the next step is collecting voltage data. The frequency of the output sensor then converted into a voltage by programming the microcontroller ATMega 8535 [15].

IV. RESULTS AND DISCUSSIONS

The Results of the initial phase of this study is a sensor characterization's results. Sensor characterization was conducted to determine the performance of the TCS230 sensor system. At this stage of characterization, it is known that the TCS 230 has a range measurements of output between 11 Hz

to 40 KHz. Visibility sensors focused if objects placed as far as 2 cm from the lens.

The next steps after the characterization is collecting frequency data from the sensor output of soybean seed varieties. Data collection from Anjasmoro soybean seed are shown in Table 1.

The frequency data from output sensor for Burangrang soybean seed are shown in Table 2.

The frequency data from output sensor for Sinabung soybean seed are shown in Table 3.

From the frequency data, indicated that the soybean which have yellow color also have different value of frequency.

This output frequency is the result of light to frequency conversion. The light-to-frequency converter reads as the function of photodiodes in TCS 230 which arranged array. This frequency value is not same with the magnitude of the light frequency as well as frequency in electromagnetic spectrum. If we would get the connection between frequency output sensor and light frequency, its need advanced study.

After we get frequency output sensor, this data will converting as voltage. The Anjasmoro soybean seed voltage data collection are shown in Table 4.

TABLE I. FREQUENCY OUTPUT SENSOR OF ANJASMORO SOYBEAN SEED

No	Soybean seed	Frequency (KHz)
1	A1	8,19
2	A2	8,56
3	A3	8,25
4	A4	8,53
5	A5	8,20
6	A6	7,73
7	A7	7,74
8	A8	8,20
9	A9	7,73
10	A10	8,22
	Average	8,15

TABLE II. FREQUENCY OUTPUT SENSOR OF BURANGRANG SOYBEAN SEED

No	Soybean seed	Frequency (KHz)
1	B1	9,88
2	B2	8,23
3	B3	7,14
4	B4	9,16
5	B5	9,51
6	B6	8,56
7	B7	8,23
8	B8	7,26
9	B9	8,31
10	B10	8,66
	Average	8,49

TABLE III. FREQUENCY OUTPUT SENSOR OF SINABUNG SOYBEAN SEED

No	Soybean seed	Frequency (KHz)
1	S1	7,00
2	S2	8,04
3	S3	7,16
4	S4	9,02
5	S5	7,39
6	S6	7,53
7	S7	7,29
8	S8	7,31
9	S9	7,76
10	S10	7,02
	Average	7,55

TABLE IV. VOLTAGE OUTPUT SENSOR OF ANJASMORO SOYBEAN SEED

No	Soybean seed	Voltage (V)
1	A1	1,97
2	A2	2,05
3	A3	1,98
4	A4	2,05
5	A5	1,97
6	A6	1,86
7	A7	1,86
8	A8	1,97
9	A9	1,86
10	A10	2,00
	Average	1,96

TABLE V. VOLTAGE OUTPUT SENSOR OF ANJASMORO SOYBEAN SEED

No	Soybean seed	Voltage (V)
1	B1	2,37
2	B2	1,98
3	B3	1,71
4	B4	2,20
5	B5	2,28
6	B6	2,05
7	B7	1,98
8	B8	1,74
9	B9	1,99
10	B10	2,08
	Average	2,04

The voltage output sensor for Burangrang soybean seed are shown in Table 5.

The voltage output sensor for Sinabung soybean seed are shown in Table 6.

Based on the data collection at Table 4, Table 5, and Table 6, we know that each of soybean have different voltage output. its indicated that although soybean seed looks yellow, they have a different voltage output sensor.

TABLE VI. VOLTAGE OUTPUT SENSOR OF SINABUNG SOYBEAN SEED

No	Soybean seed	Voltage (V)
1	S1	1,68
2	S2	1,93
3	S3	1,72
4	S4	2,16
5	S5	1,77
6	S6	1,81
7	S7	1,75
8	S8	1,75
9	S9	1,86
10	S10	1,68
	Average	1,81

V. CONCLUSION

The sensor system in this study has the frequency and voltage output. Each of yellow soybean (Anjasmoro, Burangrang ans Sinabung varieties) have different voltage output and different frequency.

The different situation at the time of sensing will affect the outcome of the sensor output. Its affect because one of the importance characteristics of an object is its color. Besides color, the other optical properties such as forwarding property (transmittance) and the reflectance properties (reflectance) of light also affects the optical properties of these materials, with changes color, then the forwarding capabilities and reflectance of an object as well will change.

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