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ICECOS 2018

INTERNATIONAL CONFERENCE ON ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

CONFERENCE PROGRAMS AND ABSTARCT

"Future energy brings the quality of human life through applied techniques and ICT Innovations"

October 02-04, 2018

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Indonesia

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ICECOS 2018
INTERNATIONAL CONFERENCE ON ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

FOREWORD FROM GENERAL CHAIR ICECOS 2018

Welcome to ICECOS 2018,

It is with a great pleasure that we extend our warm welcome to all the participants of the 2nd International Conference on Electrical Engineering and Computer Science (ICECOS) 2018. This conference held for second times and organized by Universitas Sriwijaya. The first conference in the series was held in Palembang, South Sumatera, Indonesia August 22-23, 2017. It is a good collaboration between Universitas Sriwijaya, Universiti Teknologi Malaysia, JAIST Japan, Albaha University, Saudi Arabia, University of Technology Sydney, Australia and Universiti Teknikal Malaysia Melaka. The conference in Bangka Island has attracted 66 participants from 7 countries.

The 2nd ICECOS particularly encouraged research students and developing academics to present and to discuss new and current work in the field of communication and vehicular technologies, electronics, circuits, and systems, information technologies, pervasive computing and internet of things, and power systems. 83 selected papers were presented from 133 peer reviewed paper by reviewers drawn from the scientific committee, external reviewers and editorial board.

Finally, as the General Chair of the Conference, I would like to express my deep appreciation to all members of the Steering Committee, Technical Program Committee, Organizing Committee and Reviewers who have devoted their time and energy for the success of the event.

In the end, I hope you have enjoyed the conference and the beauty of Bangka Island.

ICECOS 2018
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Parallel Session

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Optimization of Coffee Bean Drying Using Hybrid Solar Systems and Wi-Fi Data Communication

Paper ID : 1570473809

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Abstract - Coffee bean is one of high commodity from Indonesia. The drying process is the important step in its production. The process is to determine the moisture level of the coffee bean which also affects to the quality of a coffee. However this process takes a long time. This paper presents the optimization of the drying process of Robusta coffee bean Indonesian national standardization. The technology consists of hybrid solar systems as efficient resource energy and moisture level indicator using Wi-Fi data communication to efficient the operator. Test results showed that hybrid solar systems able to produce temperature 75˚C in sunny day and temperature 45˚C - 50 ˚C in mild weather. It can speed up drying processing and keep the texture of coffee bean. Besides that proposed moisture level indicator can help the operator by Wi-Fi data communication in 10 m to 100 m. It is more efficient and easy to produce coffee bean Indonesian national standardization.

Keywords : hybrid solar systems; moisture level indicator; Wi-Fi data communication; coffee bean Indonesian national standarization

Optimization of Coffee Bean Drying Using Hybrid Solar Systems and Wi-Fi Data Communication

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***Abstract*— Coffee bean is one of high commodity from Indonesia. The drying process is the important step in its production. The process is to determine the moisture level of the coffee bean which also affects to the quality of a coffee. However this process takes a long time. This paper presents the optimization of the drying process of Robusta coffee bean based on Indonesian national standardization. The technology consists of hybrid solar systems as efficient resource energy and moisture level indicator using Wi-Fi data communication to efficient the operator. Test results showed that hybrid solar systems able to produce temperature 75˚C in sunny day and temperature 45˚C - 50 ˚C in mild weather. It can speed up drying processing and keep the texture of coffee bean. Besides that proposed moisture level indicator can help the operator by Wi-Fi data communication in 10 m to 100 m. It is more efficient and easy to produce coffee bean Indonesian national standardization.**

Keywords*— *coffee bean Indonesian national standardization, hybrid solar systems, moisture level indicator, Wi-Fi data communication,

I. INTRODUCTION

Coffee is an important beverage in most societies around the globe. Not only for consumers delight of drinking it but also for its economic value for the coffee bean producing and exporting. The subtropical and equatorial regions provide good conditions for coffee to be grown. Therefore, countries that dominate the world's coffee production are found in South America, Africa, and Southeast Asia.

Indonesia was the fourth largest producer of coffee in the world in 2016-2017 [1]. Coffee that is sold on the world market is usually a combination of roasted beans of two botanic types: Arabica and Robusta. Robusta coffee production in the world has reached 37%-40% [2][3]. Robusta is easier to care for and has greater crop yield than Arabica, so is cheaper to produce.

In a series of production processes, the drying process is one of important step because it includes the standard of moisture, which takes a long time. Therefore, this paper aims to optimize it. The combination of solar collector and photovoltaic as hybrid solar systems used to reduce the drying time becomes shorter and maintain the quality of the texture, cleanliness of the coffee beans based on Indonesian National Standardization [4]. In addition, in that process also regulated 12% moisture level of the coffee beans by designing the moisture detection tool [5]. The main part of this tool consist of IC NE555 to generate wave frequencies, where the frequency data obtained will be converted to water content, the Arduino Uno as a controller, Wi-Fi module and esp8266 to transfer data. By using this technology, the operator can get efficient method and good production.

II. DRYING PROCESSES DESIGN

There are some steps in the coffee production. That are planting, harvesting, drying, roasting and grinding. The drying process is one of complex term. There are two methods in this step, called dry method and wet method.

Dry method used for unripe coffee cherries. Usually the color is yellow or green, in which coffee cherries are dried whole without pulping and milled when thoroughly dried, removing the dehydrated pulp, parchment skin and silver skin. Whereas, wet drying method used for ripe coffee cherries and its skin has red color. There are step to removal of the pulp, fermentation of the mucilaginous material on the parchment skin, and washing precede drying, after which the coffee is graded and bagged for shipment.

The complexity of drying process make producer of coffee bean need technology to solve and optimize that problem. It has related to the time and economic. Therefore, this paper presents an optimization technology.

A. Hybrid Solar Systems

Distributed renewable energy has emerged as a promising resource because of its environmental friendliness and economic considerations [6]. Renewable energy sources such as solar energy is widely available on earth and have attracted much interest in both research and practical applications [7]. Solar energy is suitable for agriculture and marine products, is designed, constructed, evaluated in tropical and subtropical climate conditions such as Indonesia.

Indonesian territory has a beam relatively abundant sun, located at equatorial regions that have tropical climate and solar radiation almost throughout the year. The uniformly warm waters that make up 81% of Indonesia's area ensure that temperatures on land remain fairly constant, with the coastal plains averaging 28 °C. Because of that, the development of appropriate technologies which uses solar as an alternative energy is very suitable in the field of dryers utilizing solar power for Indonesian yields.

One of the largest Indonesian agriculture products is coffee bean. That is because the geographical position of Indonesia in tropical area. The local residents usually dried their coffee bean with traditional method. It is done by spread it on the land in the direct sun. There are several

disadvantages such as requires large open space area, long drying times and depend on the availability of sunshine, susceptible to contamination with foreign materials. Otherwise insects and fungi, which thrive in moist conditions, render them unusable. Moreover, in this method have led to unhygienic for human consumption and are low quality coffee bean. Therefore, innovation is considered very important for quality improvement. Designing a tool to drying coffee bean can be a good way and efficient.

Solar collectors can be defined as a heat transfer system that generates heat energy by using solar radiation as the primary energy source. When the sun impinge on the solar collector absorber, some light will be reflected back to the environment, while most of it will be absorbed and converted into heat energy, and heat is transferred to the circulating fluid in the solar collector [8]. There are three types of solar collectors are classified into solar thermal collector system and also has a correlation with the classification of solar collectors based on the dimensions and geometry of its receiver. There are flat plate collector, concentrating collector, and evacuated tube collector.

Flat plate collectors are a very useful tool for low to medium temperature heat collection from the sun. They can be used for many purposes including the various thermal desalination methods from low to medium capacities [9]. This type is designed for applications that require thermal energy at temperatures below 100 ° C. The main advantage of a flat plate solar collector is that it utilizes both components of solar radiation that is through the direct beam and distribution, does not require tracking the sun and also because of the simple design, few require maintenance and low manufacturing costs.

This collector has components such cover to reduce heat loss by convection to the environment, flat absorber to absorb heat from solar radiation, channel as the working fluid transmission line, isolator to minimize the heat loss by conduction from the absorber to the environment and frame as a load-bearing structure forming and collector.

Chamber is a place the drying process, in which the hot air generated by collector channeled into the chamber to dry the product which will dry. It made of plate 0.35 mm thick zinc painted with opaque black color, in order to absorb heat faster. For wall deliberately not made an insulator, so that the heat due to solar radiation on the wall can be help the drying process. In the chamber equipped the doors are useful for insert and remove products dried. The top side made chimney air conditioning, aims to facilitate the circulation the air in the drying process.

That system is hybrid by photovoltaic include the energy storage. It has been used to optimize the system. Photovoltaic is used as an energy backup. As it is known that the weather is unpredictable. Thus, when there is no sunlight, the stored energy from photovoltaic can be used to supply energy the heater and fan. This treatment is to create a hot air manually. So, the chamber keep receive hot air and remain in the drying process. The specific calculations also have been devised to determine the size of the PV, the size of energy storage and energy required by the heater and fan.

B. Moisture Level Indicator Using Wi-Fi Technology

The drying process has related to the moisture level of coffee bean. The drier coffee bean means smaller the moisture level. It means the quality of coffee bean depend on it. Therefore, in this paper aims to design moisture level indicator "Fig. 1". It shows the value of moisture, condition and send the data to the operator via Wi-Fi. So, the operator no need list the data by hand.

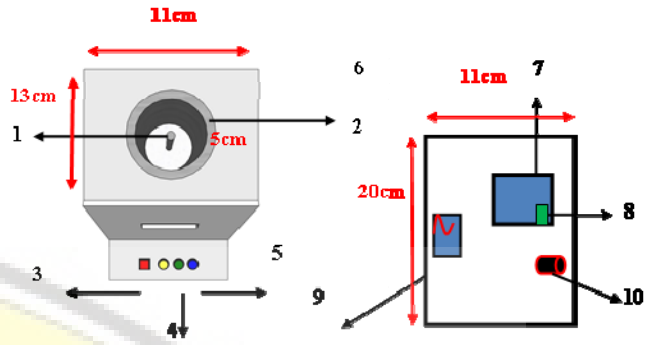

Figure 1. Moisture level indicator

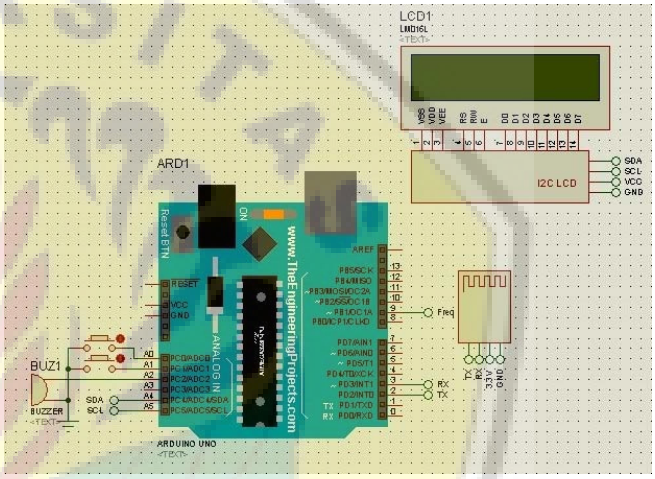

Figure 2. Moisture level indicator components

"Fig. 1" consists of:

1) The central part of the funnel: as a place to sample the coffee beans will be measured the water levels.
2) The central part of the funnel: as a place to sample the coffee beans will be measured the water levels.
3) Power button: Function to switch on the tool after the given voltage source.
4) Start button: Function to start the measurement of water content in coffee beans.
5) Reset button: Function to reset the tool after performing the measurement of water content in coffee beans.
6) The Arduino Uno: as the governing system from the tool.
7) NE555 IC: as the wave generator is defined.
8) Resistor: as barriers.
9) The Wi-Fi Module: as a medium of communication over long distances with a personal computer.
10) The Buzzer: as an indicator that the tool performs measurements.

Inside of the moisture level indicator consist of I2C LCD circuit, series of Wi-Fi, and a series of indicators. I2C LCD sets in this system used as a display system. In this tool the LCD displays all of the process undertaken by the Arduino Uno Assembly, to display data that is unreadable by a series of sensors. The series of Wi-Fi as a communication part which connect to the Arduino Uno Assembly. It has function to send data to a computer wirelessly. If the operator sets the start button, means start measurement. Series of reset button is to reset after making the measurements. Series of buzzers in this tool is for water content measurement indicator. Series of sensors "Fig.3" used to detect level of water in the coffee bean. It affects to the moisture of coffee bean. The frequencies are generated by NE555 IC processed by an arduino. It changes water content in percent of unit.

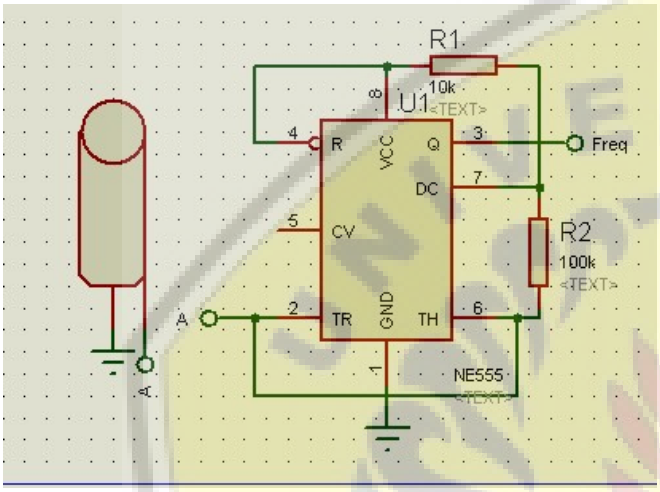

Figure 3. Series of sensors

III. RESULT AND DISCUSSION

Hybrid solar systems can increase the temperature for coffee bean in the drying box. It works by the solar collector concept which can produce hot fluid or air to the coffee bean area which connected by the exhaust fan. In this condition, exhaust fan need electricity and photovoltaic can used to fulfill the energy demand. Photovoltaic also can used to activate the heater in cloudy weather.

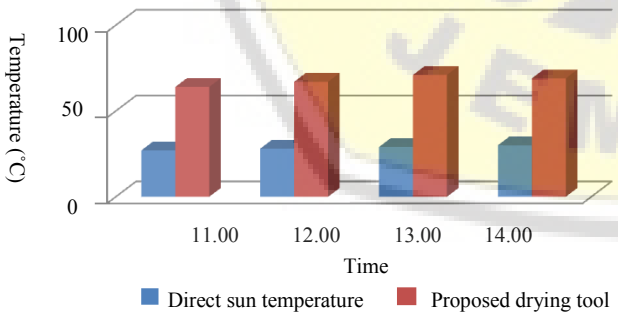

Figure 2. Temperature comparison between direct sun and proposed tool

"Fig. 2" shows the results of the temperature comparison between direct sun and proposed drying. The proposed drying tool produced higher temperature. It can produce temperature 75˚C in sunny day and 45˚C - 50 ˚C in mild weather. Although based on the Indonesian national standardization, the temperature should be on 105˚C, this technology can reduce the time drying. Also, this technology can keep supply energy to drying in the cloudy weather or rain season. It is done by photovoltaic which can activate the heater with free energy. Therefore, this technology can be complement to conventional drying.

TABLE I. MOISTURE LEVEL TEST RESULTS COMPARISONS

No.	Moisture Level		
	Digital Tool	*Proposed Tool*	*Error*
1	11,2 %	11,2 %	0 %
2	11,6 %	11,7 %	0,86%
3	11,9 %	11,9 %	0 %
4	12,4 %	12,2 %	1,61 %
5	13,3 %	13,2 %	0,75 %
6	13,5 %	13,4 %	0,74 %
7	13,7 %	13,7 %	0 %
8	13,8 %	13,9 %	0,72 %
9	14,6 %	14,3 %	2 %
10	15,0 %	14,7 %	2 %

On the other hand, there is comparison for other aspect. "Table 2" is comparison of test results between digital tool and proposed tool on some samples. It shows small percent error from 0% to 2%. It means the proposed tool have a good performance to measure the moisture level of coffee bean. The difference is on the Wi-Fi technology for operator. Data for the moisture level send directly. It means can save the time and energy to process for the next step. The results of testing distance using Wi-Fi to send data starts at a 10 meters. The data can be transmitted in ranging from 10 to 100 meters. When data at 110-120 meters distance, it can not be delivered.

Displayed data for the moisture level is generated by visual basic. It contains of port of the library. Device manager in control panel used to view that port. In the next column is to read the value of the moisture content in the tool. Visual basic has the connect button that serves to connect the tools and decide with a personal computer.

IV. CONCLUSION

This paper proposed a system design to drying robusta coffee bean based on Indonesian national standardization using hybrid solar systems as sources and Wi-Fi data communication for efficiency. Test results showed that hybrid solar systems able to produce temperature 75˚C in sunny day and temperature 45˚C - 50 ˚C in mild weather. It can speed up drying process and keep the texture of coffee bean. Besides that, proposed moisture level indicator can help the operator by Wi-Fi data communication in 10 m to 100 m. It is more efficient and easy to produce coffee beans Indonesian national standardization. The drawback of this technology is need a large dimension of the drying cabinet if the amount of coffee bean to be drained is a lot. This can effect to the procurement of materials that were quite expensive. In addition, with the limited range for Wi-Fi technology requires that the equipment and operator are in a limited position.

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