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Control of Coconut Shell Briquette Making Machine Based on Arduino Microcontroller

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ABSTRACT

The arduino microcontroller processing system as the brain of this system organizes and controls the automation process. The proximity sensor will be used to measure and calculate the distance between the sensor and the object to be cut. The arduino microcontroller will control the servo motor and proximity sensor needed to drive the mechanical part. Automatic briquette printers can be used to save time and increase the amount of production in a short time. After testing the briquette printer automatically and manually, it is known that when using an automatic briquette printer is able to produce 118 briquettes in 480 seconds, while when using a manual briquette printer is only able to produce 43 briquettes with the same time of 480 seconds. From the results of the comparison of automatic and manual briquette printers, it can be compared that the time efficiency of automatic tools is an average production cycle of 96 seconds with the number of briquettes printed 23.6 pieces with a score of 8, while in manual tools the average production cycle is 96 seconds, the average number of briquettes printed is 8.6 pieces and the average quality score is cut 7.

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1. INTRODUCTION

Charcoal briquettes are one of the alternative fuels used as a substitute for fuel oil and are an environmentally friendly energy source. The material for making charcoal briquettes is coconut shells. West Sumatra Province is one of the coconut producing areas that has quite large development potential. The area of coconut plantations in West Sumatra Province in 2018 with a land area of 87,300 Ha and a total production of 78,943 tons. The largest coconut production is in Padang Pariaman Regency with a total land area of 40,312 Ha and a total production of 36,556.31 tons [1]-[3]. The sub-districts in Padang Pariaman Regency that produce coconuts are Sungai Geringging District (6,369.04 tons), IV Koto Aur Malintang District (3,415.79 tons) and Ulakan Tapakis District (2,699.03 tons). Sungai Geringging District is the highest producer in Padang Pariaman Regency [4]-[5]. Coconut shells are often thrown away because many people do not know how to produce them. Therefore, coconut shells are chosen as the main raw material for making charcoal briquettes [6]. Utilizing coconut shells to make charcoal briquettes can also reduce solid coconut shell waste..

The rapid development of technology every day has proven that technology can increase the efficiency and availability of facilities that support human survival [7]-[8]. The design of this coconut shell charcoal briquette printing tool uses a hydraulic system. The working principle of this charcoal briquette printing tool is with the pressing force obtained manually by pressing the Hydraulic lever, but the quality of the dimensions of the briquettes produced is not constant and still requires more labor and time [9]. Several studies for controlling the Coconut Shell Charcoal Briquette printing with a Pneumatic System have been developed with several methods, such as using PLC Control [10] and IoT-based [11]. The environmental

impact of making briquettes from coconut shells is considered an environmentally friendly alternative compared to fuel for the production process and waste from the briquette making process [12]-[16]. Therefore, the briquette printing machine needs to be managed properly to avoid negative impacts on the environment.

In this paper, it is proposed to control the coconut shell briquette printing machine using Arduino which can work automatically. This tool is designed using several components, such as a servo motor for the cutter, a motor for the lever control and an infrared proximity sensor as automation of the tool. All equipment is controlled using Arduino Uno.

2. METHOD

Tool design is an important thing to do in determining what components will be used when making a final assignment, this is so that the tool to be made works as desired. This research method includes designing and making hardware and software. Hardware design is made using the SketchUp application, an application used to create 3D designs for briquette printing automation. While software design uses the fritzing application to create diagrams and Arduino IDE to create tool programming sketches.

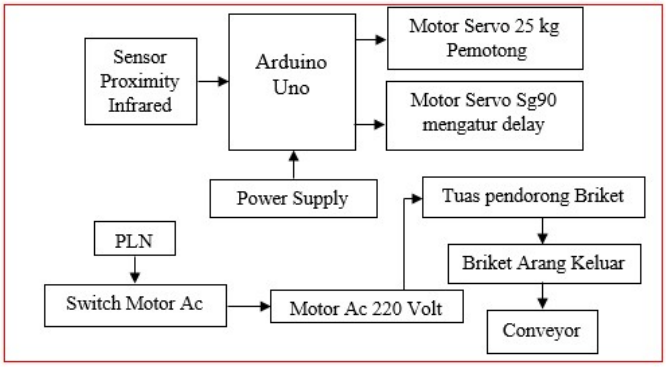

Figure 1. Diagram block of proposed system

Based on the block diagram shown in Figure 1, there are several main components of the automatic briquette printing tool based on the Arduino microcontroller, namely the Arduino microcontroller as the main component that functions as a controller in the output control system, the distance sensor functions to measure and calculate the distance between the sensor and the object to be cut, the 25 kg servo motor is properly installed will function as an optimal briquette cutting tool, the power supply functions to provide the electrical power needed by electronic devices, the switch is used to disconnect and connect the current to the 220 Volt AC servo motor, the 220 Volt AC motor functions to regulate the position of the briquette mold speed with high precision, the lever on the machine functions as a mechanical drive to produce pressure on the material and the briquette drying container functions as a process of transferring material from the cutting stage to the briquette drying stage.

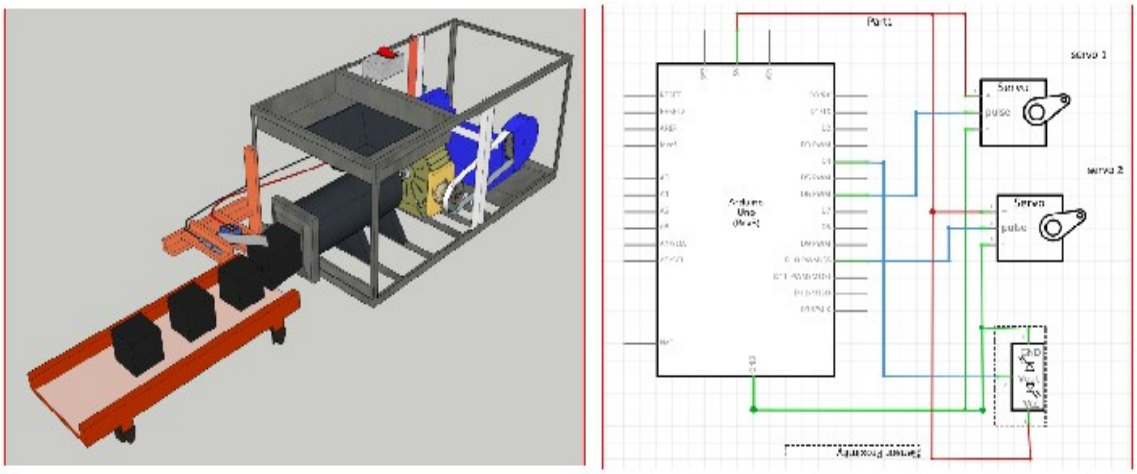

Figure 2. Design mechanic and circuit control of proposed system

The working principle of the automation of the coconut shell briquette printing tool based on the Arduino microcontroller is the Arduino Uno processing system as the brain of the system functions to regulate and control the automation process. The distance sensor will be used to measure and calculate the distance between the sensor and the object to be cut, the printing mechanism will be designed to press the coconut shell charcoal that is inserted into briquettes with the right pressure. The Arduino Uno will control the motors needed to move the mechanical parts of the printing tool and apply the necessary pressure. The general working principle involves the integration of complex hardware and software to automate the coconut shell printing process, with the Arduino microcontroller as the main controller. Figure 2 shows the mechanical design of an automatic coconut shell briquette making tool based on an Arduino microcontroller with a frame size of 50 cm x 25 cm x 25 cm and a control circuit using Arduino..

3. RESULTS AND DISCUSSION

Testing of this tool is done by assembling all the components that will be needed, starting from the control system, namely Arduino Uno, infrared proximity sensor, servo motor and conveyor that will transfer materials from one stage of production to the next with high efficiency and speed. Before assembling, check all components to see if they are functioning properly. Testing is done by means of two comparisons, namely an automatic briquette printing tool and a manual briquette printing tool as well as a comparison of the time efficiency of the automatic printing tool and the manual printing tool. Figure 3 shows the tool testing process carried out and the coconut shell briquettes obtained from the results of the tool testing.

Figure 3. Tool testing process

The testing stage begins by connecting the power supply to the power source, when the switch button is activated, the 220 volt servo motor will move. This servo motor is important because it can regulate the speed for printing briquettes. After that, the machine gearbox will adjust the speed and power that will go to the push lever. Furthermore, the lever on the machine will move to apply pressure to the material that will be printed into briquettes. The Arduino microcontroller acts as the main controller in the system. The infrared proximity sensor will detect the size and calculate the distance of the briquettes to be processed. After that, the servo motor will move to cut the briquettes that have been detected by the sensor. The briquettes that have been cut and entered the container will be moved to the drying place.

The reliability of the automatic coconut shell briquette molding machine made in this study was compared with the manual tool. Reliability was reviewed from the number of briquettes cut and the quality of the cuts within a specified time. Both tools were tested for varying times, starting from 30 seconds, 60 seconds, 90 seconds, 120 seconds and 180 seconds. Figure 4 shows the test graph of the automatic coconut shell briquette making machine made in this study. The tool made can cut 5 briquettes in 30 seconds with very good cutting quality, so it can be given a score of 8 out of 10. The machine can cut 14 briquettes in 60 second, 23 briquettes in 90 second, 30 briquettes in 120 second and 46 briquettes in 3 minutes or 180 seconds, as shown in Figure 4. The quality of the coconut shell briquette pieces produced remains good in every test.

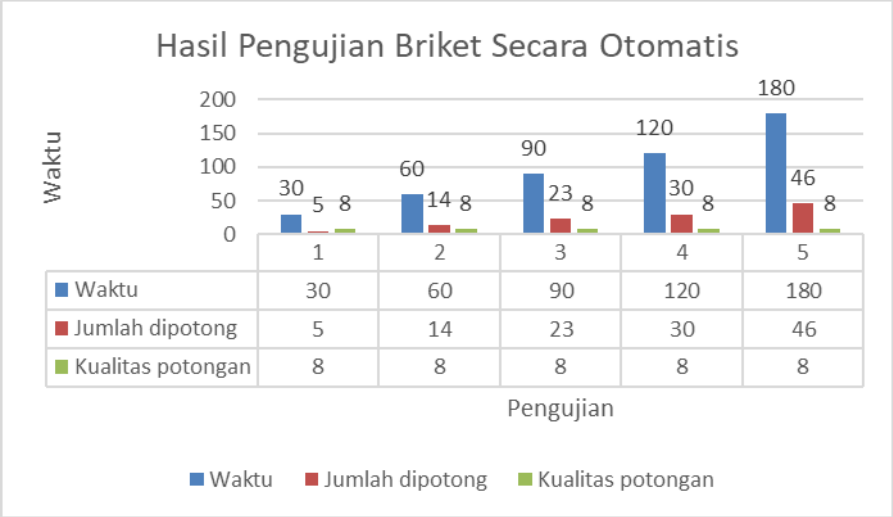

Figure 4. Automatic briquette making machine test result graph

The results obtained from the automatic briquette making machine made in this study were much better compared to the results of manual tool testing, as shown in Figure 5. The manual briquette making machine can only cut 1 briquette in 30 seconds, 3 briquette in 60 seconds, 6 briquette in 90 seconds, 11 briquette in 90 seconds and 22 briquettes in 3 minutes, while the proposed automatic coconut shell briquette making machine can cut 46 briquettes. Figure 5 also shows that the quality of the briquette pieces produced by the manual briquette molding machine is not as good as the automatic briquette molding machine with a score of 7 out of 10.

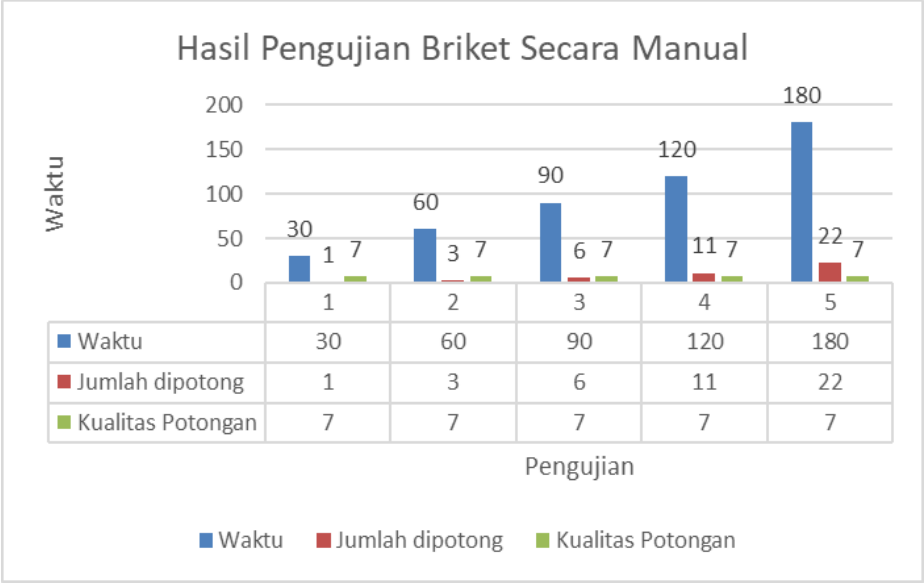

Figure 5. Manual briquette making machine test result graph

These results show that the automatic briquette printing machine using Arduino proposed in this study has provided better results than the manual briquette printing machine. This can be seen from the number of briquettes that can be cut and the quality of the cuts produced by both machines. Judging from the number of briquettes that were successfully cut, the automatic briquette molding machine can cut 23.6 briquettes in 96 seconds, while the manual briquette molding machine can only cut 8 briquettes in the same time. The quality of the briquette pieces produced by the automatic briquette molding machine is better than that produced by the manual briquette molding machine, as shown in Figure 6. These results indicate that the coconut shell briquette molding machine proposed in this study has produced good performance compared to the manual molding machine. In addition to being more efficient, the automatic briquette molding machine can also produce better briquette pieces compared to the manual one. All the results obtained during testing indicate that the coconut shell briquette printing machine proposed in this study has worked as desired.

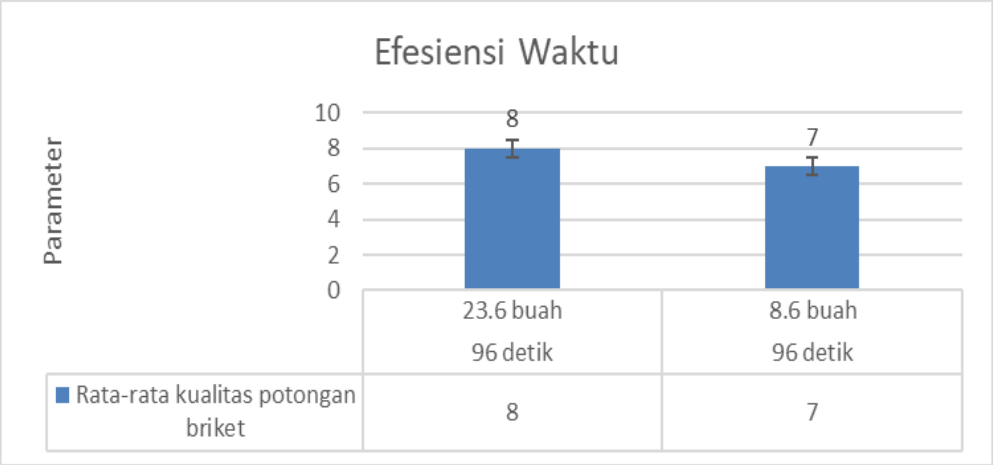

Figure 6. Comparison of manual and automatic briquette making machines

4. CONCLUSION

This study proposes a coconut shell briquette printing machine that can work automatically, so it is more efficient and effective than a manual briquette printing machine. The automatic coconut shell briquette printing machine is designed using an Arduino microcontroller as its controller center. This Arduino will drive several servo motors used in this tool. The system automation is designed using an infrared distance sensor. The performance of the proposed tool was validated through comparison with the performance of an existing manual briquette press. The test results show that the coconut shell briquette making machine proposed in this study has worked well compared to the manual briquette making machine. The machine has successfully worked faster in cutting briquettes with better cut quality compared to manual briquette molding machines. The automatic coconut shell briquette making machine that was made has been able to cut 46 briquettes in 3 minutes. This result is much better than the manual briquette making machine which can only cut 22 briquettes in the same time. The quality of the briquette pieces produced by the automatic briquette molding machine is better than the manual briquette molding machine with a score of 8 for automatic and 7 for manual. These results show that the automatic coconut shell briquette making machine using Arduino proposed in this study has worked as desired, so that it can increase the efficiency and effectiveness of briquette making..

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