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Design and Build Automatic Rice Winnowing and Weighing Equipment IoT (Internet of Things) Based

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ABSTRACT

Technological developments are growing rapidly without exception in the agricultural sector. Food needs are increasing every year in Indonesia, rice is a staple food for most Indonesian people before being distributed, it is necessary to process rice including cleaning and weighing so that it can reach the hands of buyers. This research was conducted using the R&D (Research and Development) method with a prototype development model. development procedures include the stages of needs analysis, system design, design, prototyping, testing, and validation. The design of this rice winnowing and weighing device uses the telegram application, Arduino ide which is connected to the internet as software and hardware NodeMCU ESP 8266, Arduino Uno as a controller, hx711 load cell sensor as a weighing sensor, power supply as a power supplier, relay module, LCD 16 x 20, buzzer, MG996 servo motor, and AC fan that can be controlled remotely using IoT (Internet of Things).

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1. INTRODUCTION

The development of telecommunications and information technology in Indonesia is growing rapidly, one of which is in the field of the Internet of Things (IoT). A scenario that is used on objects so that data and information can be sent using a network with no human intervention is used today in the world of 4.0. remotely called the Internet of Things (IoT) [1]. The Internet of Things (IoT) is something that certainly exists in every field without exception in agriculture. The growing population in the world, so that from year to year will certainly have an impact on increasing the need for food, is getting bigger which makes the agricultural system have to be better than before [5]. Increasing agricultural production currently has many obstacles, namely in agricultural production, modern technology agriculture, agricultural drones, animal monitoring, and modern greenhouses. The application of Internet of Things technology is a breakthrough that can make agricultural production more effective, and sustainable and accelerate the process of helping jobs farmers [3].

The increasing development of Internet of Things (IoT) technology today has made many changes to the agricultural system in this era [6]. The emergence of new technologies can be used by farmers to increase food production. Developed countries currently easier to adopt technology more than developing countries [7]. In developing countries such as Indonesia, farmers still use traditional and conventional methods compared to advanced technology, one of these things happens because farmers do not understand how to access the latest technology, inadequate knowledge, costs, and uncertainty about the effectiveness of the new technology [2].

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To overcome this problem the Internet of Things (IoT) can be applied to help the performance of farmers in maximizing food production in Indonesia, one of which is a rice winnowing tool. The use of winnowing and rice weighing tools is still conventional, farmers in Indonesia still use winnowing tools in the form of winnowing tools made of bamboo so it takes a lot of time and energy [8]. The weighing equipment used by farmers is also an ordinary weighing tool so that after the winnowing process is complete, the farmer must manually weigh the rice again [4].

Over time, these tools can be modified so that their use is more effective. Winnowing and weighing rice tools are made to maximize the performance of farmers, with the concept of a tool that can clean and weigh rice simultaneously using one tool then the rice that has been cleaned and weighed will be directly recorded in a telegram application [9]. this can help with three jobs, namely cleaning, weighing, and recording the results of the rice. This will certainly be very effective and efficient in helping the performance of farmers in Indonesia[10].

2. RESEARCH METHOD

2.1. Device Design

In this study, a device design was made based on the needs that exist in the winnowing and automatic weighing device. The research framework is as follows.

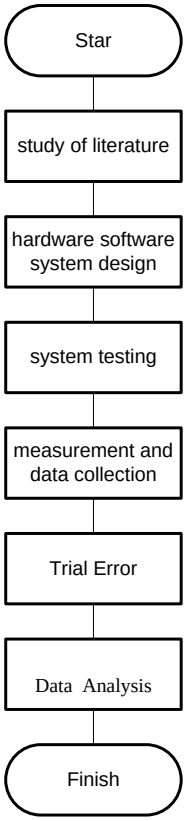

Figure 1. Research framework flowchart

Figure 1. Describes the Flowchart. The research framework starts with a literature study, hardware and software system design, system testing, trial and error, and when the tool has been completed it will be analyzed.

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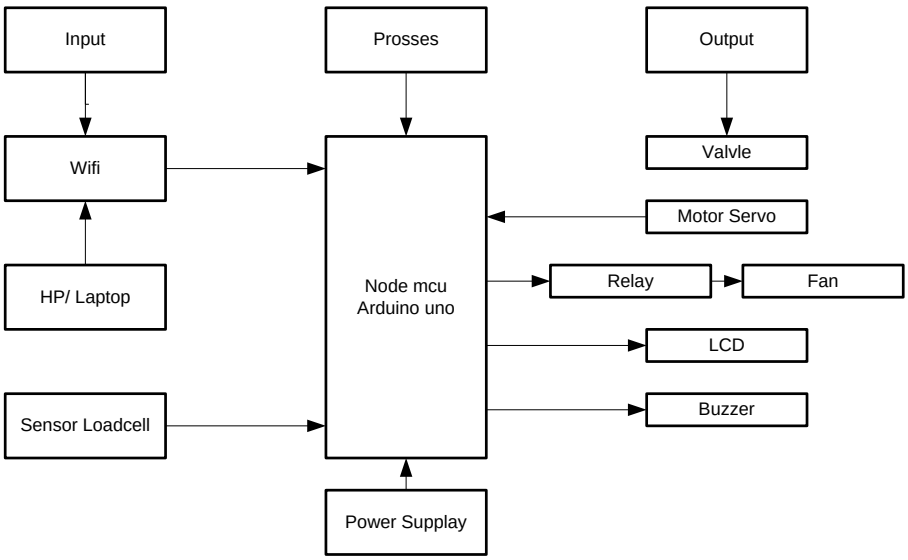

Figure 2. Block diagram of hardware

In figure 2. The process is carried out by the MCU and Arduino Uno nodes that communicate serially and function as a microcontroller, the power flow is obtained by the power supply. The output is obtained from the servo motor which functions to move the valve, the relay functions to control the flow of electricity, the LCD serves to display the results, and the buzzer functions as an alarm signal that the process has been completed. Furthermore, the input is in the form of wifi or hotspot and the loadcell sensor is used as a weight sensor.

2.2. How Automatic Winnowing and Weighing Tools Work

The workings of this automatic winnowing and weighing device are that when the rice enters the reservoir, it starts controlling the tool using a telegram to turn it on then press /star a notification will appear on how to use it starting from speed 1 for low speed, speed 2 for medium speed and speed 3 for high speed, then a notification in the form of the weight of rice that you want to process starting from 1kg to 5 kg if it is appropriate the valve will open, rice will be winnowed using a fan, dirt will fly to the side, while clean rice will fall into the loadcell sensor if the weight has reached then the valve will be automatically closed, the fan will turn off and an alarm will sound indicating the process has been completed, then a notification will appear on the tool's LCD and a telegram in the form of weighing completed.

3. RESULTS AND DISCUSSION

3.1. RESULTS

The design of automatic winnowing and weighing tools based on IoT (Internet of Things) is the design of tools that can be controlled using telegram. The appearance of the tool is as follows.

1. Display of Automatic Winnowing and Weighing Machine.

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Figure 3. Automatic winnowing and weighing display

Figure 4 This is a display of the automatic winnowing and weighing machine, the machine has a height of 130 cm and a width of 60 cm with the function of cleaning and weighing rice simultaneously.

Figure 4. Display in automatic winnowing and weighing

In Figure 5. There is a series of automatic winnowing and weighing machines, the circuit consists of various components that are arranged to run the machine properly.

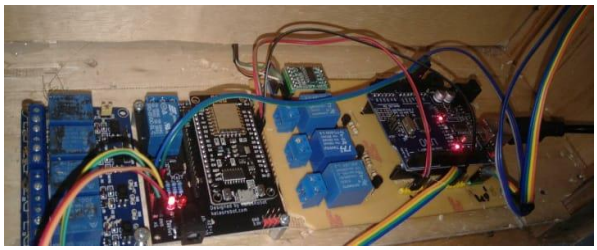

Figure 5. Display of automatic winnowing and weighing circuit

In Figure 8. There is a series of automatic winnowing and weighing machines, the circuit consists of various components that are arranged to run the machine properly.

2. Automatic winnowing and weighing device control application.

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The application used to control this automatic winnowing and weighing device is a telegram application that will send notifications in the form of messages.

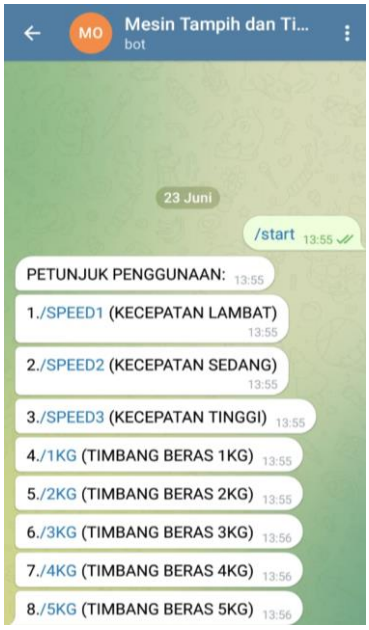

Figure 6. The initial appearance of telegram

In Figure 6. Contains the initial display of the Telegram application, if you want to start then type a star then automatically a message notification will be sent in the form of usage instructions.

Figure 7. Telegram display at work

In figure 7. Contains the display of the telegram application while working if you want to start then type the desired weight for example /1 kg and select a speed for example /speed 1 then a notification message will automatically be sent in the form of weighing 1 kg, slow speed and when finished a notification will come out weighing is complete.

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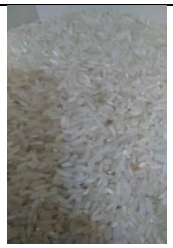
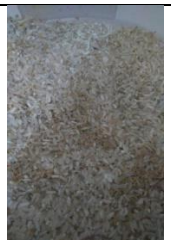
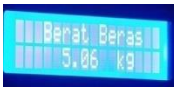
3.2. Test

Table 1. Test Results

Heavy	Speed	Tool results	Digital scales	Before cleaning	After cleaning
 1 kg	 Speed 1	 1050 g	 1042 g		
 2 kg	 Speed 3	 2060g	 2055g		
 3 kg	 Speed 3	 3060g	 3062g		
 4kg	 Speed 2	 4060g	 4060g		
 5kg	 Speed 3	 5060g	 5057g		

In table 1. Trials using 3 speeds, namely speed 1 low speed, speed 2 medium speed, and speed 3 high speed. The weighing process is carried out for 5 weights, namely 1 kg, 2 kg, 3 kg, 4 kg, and 5 kg, this can be seen in the picture above.

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3.3. Bibliography and Citation in Text

In the research, automatic rice winnowing and weighing tools were measured and tested using rice weighing 1 kg, 2 kg, 3 kg, 4 kg, and 5 kg. The rice winnowing process uses an AC fan where the dirt will fly to the side while the clean rice will fall under the loadcell sensor. As for sending data, the data sent is in the form of weight data that is obtained from the weight sensor or loadcell and can be seen on the LCD hardware and can also be controlled on the telegram application. During the measurements and tests carried out, it can be seen that the condition of the rice is dirty and the weight of the rice has not been weighed when it enters the top of the funnel. Measurement of weight is divided into 3 times, namely using speed or speed 1 means low speed, speed 2 means medium speed, and speed 3 means high speed.

Sensor measurements using speed 1 or low-speed results obtained on average have a tolerance of 50g while the results from digital scales get an average difference of 46.8g, meaning that the tolerance for a weight of 50g is about 5%, and the accuracy obtained is around 95%. Sensor measurements using speed 2 or medium speed results obtained on average have a tolerance of 60g while the results from digital scales get an average difference of 50.8g, meaning that the tolerance for a weight of 50-60g is about 5% accuracy, which is around 94%. Sensor measurements using speed 3 or high-speed results obtained on average have a tolerance of 60g while the results from digital scales get an average difference of 60g, meaning that the tolerance for a weight of 50-100g is about 5%, the accuracy obtained is around 94%.

At the time of measurement, it can be analyzed that the accuracy of the loadcell sensor is not good, this is due to the small diameter of the sensor so the rice that falls on the right side will weigh differently if it falls to the left side, therefore modifications are needed for the heavy sensor by making a buffer using plywood in the form of round to the top and bottom. The fan and valve controlled by the servo motor can be turned on as needed. In this study, the fan and valve will turn on and off automatically. The fan will be controlled at 3 speeds, low, medium, and high. While the valve controlled by the servo motor previously had problems because the servo motor could not pull the valve properly, which caused too much excess weight, therefore modification of the valve using acrylic was shaped in such a way that it could open and close automatically.

Data transmission is carried out serially from the Arduino Uno to the MCU node which can then be controlled using the Telegram application as desired. The results of the rice for speed 1, namely rice, can be said to be not very clean because the wind obtained is not strong, for speed 2 the rice is clean because the wind is moderate, and for speed 3 the rice is clean, but some grains of rice fly to the dirt catchment, this is because the wind is too strong. The results of the rice tray are quite good, the dirt in the form of powder goes to the left side, and several grains of rice fly and enter the dirt place, this happens because the mass is small and the fan at speed 3 is too tight.

4. CONCLUSION

Based on the results of the design, measurements, and system testing that have been carried out, it can be concluded that the sensor output data is created using the Arduino Ide application then the data will be sent to the MCU node to Telegram in the form of message notifications. Furthermore, the loadcell sensor measurement data that has been processed is displayed in the form of numbers and writing on the LCD of the automatic winnowing and weighing machine. From the test results, the sensitivity of the loadcell sensor can run well, but the accuracy is 95% this is because when the valve is closed, the remaining rice that falls first enters the scale reservoir. The use of the IoT application in the form of telegram can only be accessed locally and the speed of the device response varies depending on the connection speed used.

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