AUTOMATIC SHIFTING FIELD OF DRYING CRACKERS PROTOTYPE BASED ON ARDUINO

Compiled as one of the requirements of completing the Undergraduate Program at the Department of Electrical Engineering Faculty of Engineering

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Abstrak

Pada saat ini kerupuk adalah makanan yang cukup digemari oleh banyak orang di Indonesia, tak jarang mereka memproduksi kerupuk dalam sekala kecil untuk dikonsumsi sendiri, khususnya diperkampungan. Proses pengeringan merupakan hal yang penting untuk diperhatikan karena keberhasilan produk kerupuk dan kerenyahannya tergantung dari proses pengeringan. Permasalahan yang sering terjadi adalah cuaca itu sendiri yang mana kerupuk tersebut rentan terkena hujan ketika pembuat kerupuk tidak berada dilokasi penjemuran. Karena permasalahan tersebut dibuatlah prototipe pemindah bidang penjemuran kerupuk otomatis berbasis arduino yang mampu bergerak secara otomatis dengan menggunakan motor DC dan karet sebagai konveyor penggerak bidang penjemuran. RTC sebagai pewaktu dan sensor hujan akan mendeteksi adanya air, sehingga prototipe dapat bekerja secara otomatis pada waktu yang telah ditentukan dan ketika terjadi hujan. Sensor hujan dapat bekerja dengan nilai 400 sampai 1000 dengan volume air 1 ml, pada nilai sensor 100 sampai 300 sensor tidak dapat mendeteksi adanya air. Pada kecepatan motor DC 144 rpm dengan jarak penjemuran 21 cm alat ini membutuhkan waktu penjemuran dan waktu kembali yang berbeda-beda, setelah dilakukan beberapa percobaan waktu penjemuran dan kembali membutuhkan waktu dibawah 1 detik dengan nilai yang berbeda-beda. Untuk mengoptimalkan alat ini digunakan nilai sensor 400 sampai 1000 sehingga sensor lebih sensitif terhadap air, kualitas dan pemilihan bahan yang tepat sangat dibutuhkan untuk membuat konveyor sebagai penggerak bidang penjemur agar waktu penjemuran dan waktu kembali memiliki nilai yang lebih konstan.

Kata Kunci: Arduino, RTC, Sensor Hujan, Penjemur Otomatis

Abstract

At this time crackers is food that is favored by many people in Indonesia, not infrequently they produce crackers in small scale to consume themselves, especially in the village. The drying process is important to note because of the success of the crackers and its dry products depend on the drying process. The most common problem is the weather itself, where the crackers are vulnerable to rain when the cracker maker is not located in the drying area. Because of these problems, an automatic shifting field of drying crackers was made that was able to move automatically using a DC motor and rubber as a drying drive conveyor. The RTC as a timer and rain sensor will detect the presence of water, so that the prototype can work automatically at the specified time and when the rain occurs. The rain Sensor can work with a sensor value of 400 to 1000 with a water volume of 1 ml, at sensor value of 100 to 300 the sensor can not detect the presence of water. At the speed of DC 144 RPM motors with a drying distance of 21 cm, this tool requires different drying times and return times, after several trials of drying time and returning it takes under 1 second with different values. To optimize this tool used sensor value of 400 to 1000 so that the sensor is more sensitive to water, the quality and selection of the right material are needed to make the conveyor as the drive of the drying area so that the time of drying and return time has a more constant value.

Keywords: Arduino, Automatic Dryer, Rain Sensor, RTC

1. INTRODUCTION

Crackers are one of the traditional processed products that are consumed in Indonesia. Crackers are known both in the age and social level of society (Afifah & Anjani, 2008). So many producers of crackers sprung up, from small scale to self consumed to large scale ones for sale. The process of making crackers one of them is the drying process, the drying process is important to be considered because of the success of the crackers and its dry products depends on the drying process. The crispiness is very determined by the water content, more and more contains water, then the crackers will be less crunchy (Soemarmo, 2005).

A common problem when in the process of drying is the weather itself, where crackers are susceptible to rain when the cracker maker is not located in the drying area, especially the producers of small scale crackers for their own consumption. It is very detrimental to the manufacturer in terms of energy and time because it has to repeat the drying process again. Therefore, an automatic dryer control system was created. The electronic control system makes it easy for the operator to operate the tool and reduces the time spent monitoring equipment during the drying process, another advantage of using an automatic control system is that, even though the process is not monitored, it runs on the desired situation and the process can be set when the time is stopped by setting the drying process time. (Supriyono & Ariwibowo, 2015)

Given the importance of the drying process which greatly affects the quality of the crackers themselves, the author will build a prototype of automatic drying tool based on Arduino that is very simple and easy to operate by producers of small scale crackers located in the village. In this prototype maker will use some electronics components including DC motors and rubber, which both components are actuators that have a function as a conveyor drive field dryer. The RTC module is used as timer for recording the data. (Supriyono & Hadi, 2018). RTC become a conveyor reference so that it can work dry and restore the field of the crackers dryer automatically at the time specified in the program script. The rain sensor will detect the intensity of the water on the surface of the module, all these components will be controlled by Arduino Uno as microcontroller in this prototype.

1.1 Problem Formulation

Based on the background, a problem in the research is how to create an automatic shifting field of drying crackers that can work automatically when the rain occurs and able to operate at a predetermined time.

1.2 Research Goal

The purpose of this research is to create an automatic shifting field of drying crackers that can be applied at home to help small scale crackers that are located in the village.

1.3 Research Benefit

The results of the research are expected to be a reference to the upcoming research, especially about the automatic cracker drying tool. Assisting the producers of small-scale crackers that are located in the village to minimize the problem so as to maximize the production of crackers.

2. METHOD

In completing this research was done using several methods, among them is to consult with the supervisor, literature study, hardware designing, software designing, data retrieval and report drafting.

2.1 Literature Method

In this process, the search for references from various sources such as theses, publications, articles and other works of scientific works related to the research will be conducted.

2.2 Hardware Designing

In the manufacture of automatic dryer cracks is needed some components include, switch, rain sensor, RTC (Real Time Clock) DS1307, Arduino Uno, motor driver L298N, DC Motor, 12 volts AC-DC adapter. Planning a hardware system on automatic shifting field of drying crackers can be seen in Figure 1.

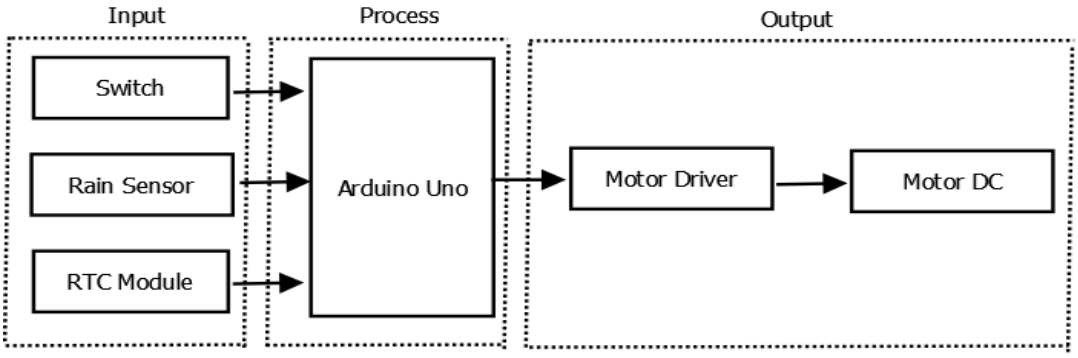

Figure 1. Hardware system diagram block

In Figure 1 the block diagram There are 3 systems among which are the input, process, and output parts, which on each system have different functions and components, in the input part has the role of the reader state and data retrieval. RTC as a timer on the prototype. Data from these two components that will regulate the dryer field is driven by a DC motor so that the drying can be done automatically with the RTC as well as the return time. Data from the rain sensors also play a role in moving the drying field when the rain occurs with the value of the sensor specified in the program script.

Then the second part there is a process that has a role as a data processor of the inputs made by the sensor and RTC, the data obtained is the value of water intensity in the rain sensor, and the time that has been set in the program script that refers on the RTC, where this data will determine the operation of this prototype.

Processed data is then transmitted in the output section, on the prototype, DC motors serve as the actuator to run orders and apply the results, motor driver L298N act to control the direction of the rotation and speed of DC motors, so DC motors can work according to the desired system.

2.3 Software Designing

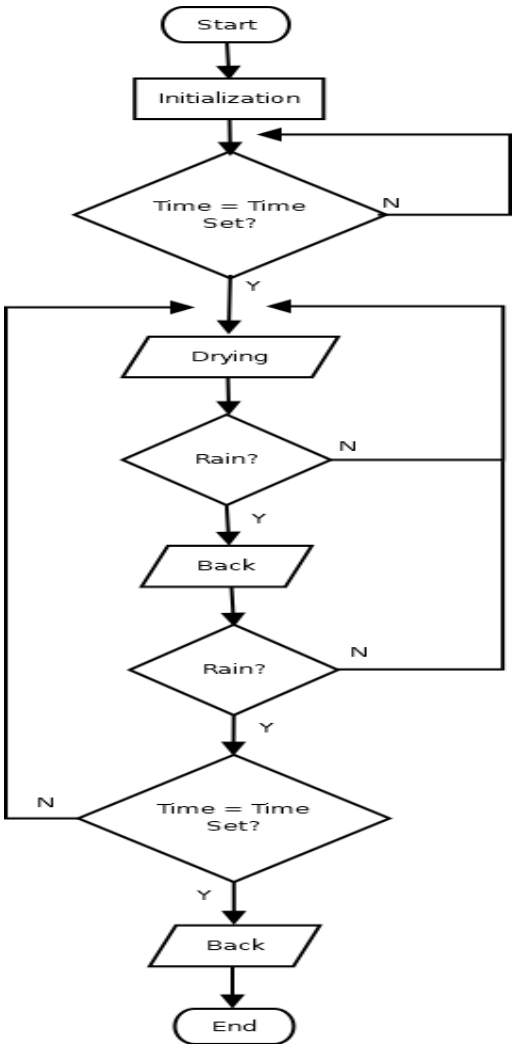

Figure 2. Work system flowcharts

Software architecture starts from creating a flowchart so that it will ease the planning of the work system tools and program creation on the Arduino. Flowchart in Figure 2 described systematics in the way this tool works, the working process starts from initializing the operating time of the tool that has been triggered in the program, in this phase the RTC is tasked with the prototype timer.

After the time of entering the present value, the conveyor will run out where the drying under the sun, during the drying process will be protected from rain by the rain sensor, as long as there is no rain The drying process will continue. When the rain sensor detects the presence of rain conveyor will move bring in the field of drying so that the crackers will be spared from the rain, when the rain sensor no longer detects the presence of water in the module or in a state of rain will occur redrying. Then this tool is also designed to be able to return automatically at a specified time after all the drying process is completed.

2.4 Electronic Circuit.

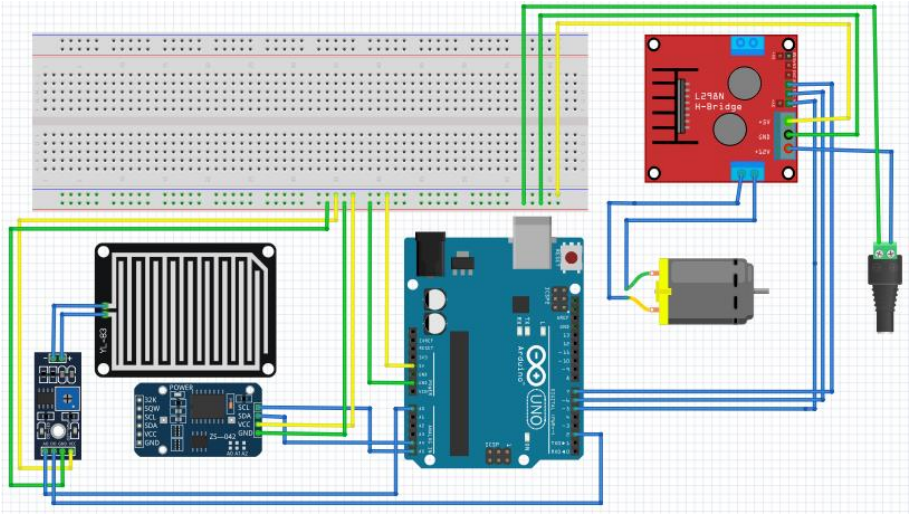

Figure 3. Electronic Circuit

In Figure 3 the planning of electronic circuit, authors using the Fritzing application, before arranging all components first download all the component libraries, because not all component libraries are in the application. After that, create the electronic circuit by connecting all the ports on the component. This stage to facilitate the process of creating an actual electronic circuit.

2.5 Data Collection

Data obtained by changing the water intensity value in the rain sensor 10 times the intensity value of 100 to 1000 with 1 ml of water. The second data retrieval process is to perform the calculation of the DC motor speed then experiment three times to determine the difference in the drying time and return to each process. Furthermore, data retrieval is done by simulating the tool work system from the beginning to end process, the simulation is done in one day from 09.00 a.m. to 04.00 p.m., by noting the sensor value when detecting water, and observing performance tools in each process.

2.6 Data Processing

The data processing process obtained is done with the following stages:

1) Record the data obtained at the time of study

2) Create a research table

3) Input data from the research results in the table

4) Analysis the results of the research that has been done

5) Giving hypotheses

2.7 Research Flow

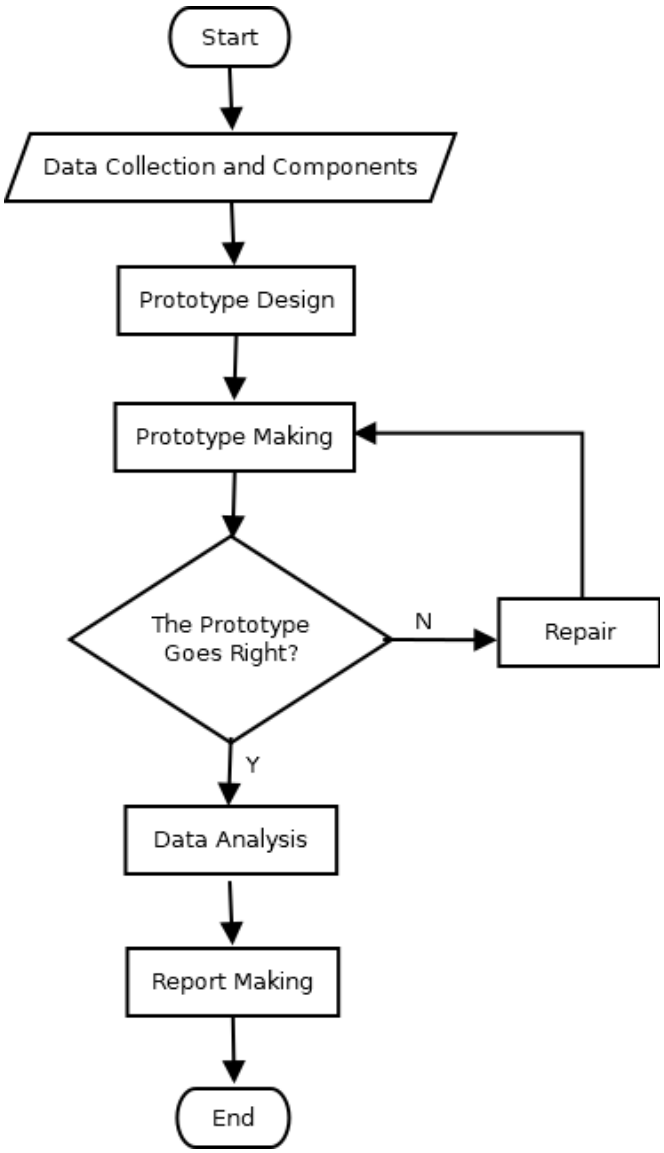

Figure 4. Flowchart of research flow

Figure 4 the flowchart of research flow, starts by collecting data in advance to find references such as datasheets and programs of each component, the electrical circuit of each component with other components, after which the program is created and the construction of prototypes. Then the testing tool is done, when the system does not run properly then it is done again repair and if the system is already running correctly then the analysis of data obtained, continued the creation of reports and research finished.

3. RESULTS AND DISCUSSION

3.1. Prototype Design of Automatic Shifting Field of Drying Crackers

From the results of data collected from various sources, it can be an automatic shifting field of drying crackers using motor DC and rubber as a conveyor, acrylic glass as a framework prototype, rain sensors to detect the occurrence of rain, RTC as a tool to be a reference to the prototype work time, and a 12 volt AC-DC adapter as a prototype power. The prototype can be seen in Figure 2.

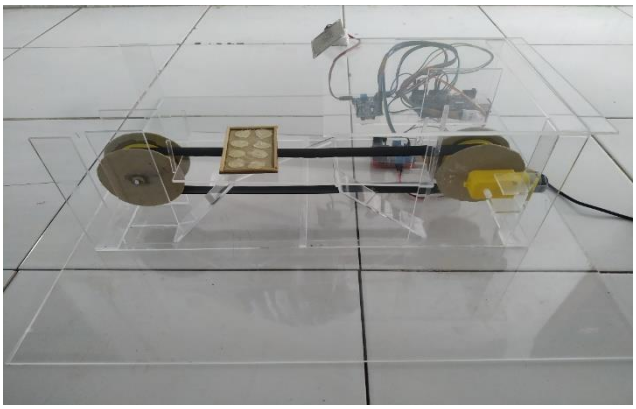

Figure 5. Design of automatic shifting field of drying crackers

3.2. Test result

Table 1. Results of Measurement of Water Intensity in Rain Sensors

Sensor Value	Water Volume	Sensor Conditions
1000	1 ml	ON
900	1 ml	ON
800	1 ml	ON
700	1 ml	ON
600	1 ml	ON
500	1 ml	ON
400	1 ml	ON
300	1 ml	OFF
200	1 ml	OFF
100	1 ml	OFF

The results of the measurement of water intensity values in the rain sensors can be seen in Table 1, that experiments have been conducted ten times to determine the condition of the sensor by replacing the sensor value in the Arduino program. Each of the tests will be done by wetting the

module on the rain sensor using 1 ml of water or equivalent to a quarter teaspoon. From this measurement obtained the result that the condition of the sensor will active at the sensor value 400 to 1000, while the condition of the sensor inactive at the time of water intensity value 100 to 300. So to optimize the function of rain sensor with high sensitivity used sensor value 400 to 1000 in the Arduino program, so that the rain sensor faster detect the presence of rain.

Table 2. Results of Measurement of Drying Time and Return Time

Trial	**DC Motor Speed**	**Analog Value**	**Drying distance**	**Drying time**	**Return Time**
1st Experiment	144 rpm	80	21 cm	0,75 seconds	0,65 seconds
2nd Experiment	144 rpm	80	21 cm	0,53 seconds	0,93 seconds
3rd Experiment	144 rpm	80	21 cm	0,81 seconds	0,78 seconds

Based on Table 2 that has been conducted a trial of three times that aims to know the process of drying the field of drying and returning, in this process DC motors and rubber conveyor have a large scale in their success the drying process. With the existence of motor driver L298N DC motor speed can be adjusted by giving the value of the Arduino program. On this DC motor without load can work at 110-260 rpm speed with analog value in 0-255 the program. With a DC motor speed of 144 rpm and a drying distance of 21 cm, there is a result that the fastest time in the drying process is 0.53 seconds and the fastest return time is 0.65 seconds. Then the slowest time during the drying process is 0.81 seconds and the latest return time is 0.93 seconds.

It can be concluded that every drying and returning process takes under 1 second, and each process takes a different time, the difference in the drying time is influenced by the quality of the conveyor itself, due to the drying field crackers are above the conveyors during which time slip can occur.

Table 3. Work System Simulation

Date	Time	Sensor Value	Water Volume	Conveyor Condition	Work Description
02 July 2019	09.00 a.m.	408	1 ml	Not Moving	Not working
02 July 2019	09.05 a.m.	1023	0 ml	Move Forward	Drying Cracker
02 July 2019	10.15 a.m.	398	1 ml	Move Backwards	Entering Cracker
02 July 2019	10.20 a.m.	1023	0 ml	Move Forward	Drying Cracker
02 July 2019	04.00 p.m.	1023	0 ml	Move Backwards	Entering Cracker

Table 3 is a result of simulated work system tools, in this simulation done on Tuesday, 02 July 2019, from 09.00 a.m. to 04.00 p.m., the simulation time is adjusted to the actual implementation time of the tool, from morning to evening. in this simulation done with several stages to know the work of each process. This tool will work at the specified time, outside of that time the appliance will not work, especially DC motors as the actuator. Simulation time is done in one day from 09.00 a.m. to 04.00 p.m., so outside of the time, the appliance will be inactive.

The first test was given 1 ml of water in the sensor panel to simulate the presence of rain, then at 09.00 am the conveyor was not moving out of the drying field, as the sensor detected water with a value of 408. Then at 09.05 p.m., the water was drained for the simulation that the rain had subsided, with a 1023 sensor value moving forward to dry the crackers. At this stage, it should be that the conveyor will start working at 09.00 a.m. because the sensor detects conveyor water does not work at that time.

Then at 10.15 a.m. the sensor detects water with a value of 398 so that the conveyor moves backward to insert the crackers, then the water is drained back at 10.20 a.m. which makes the conveyor work out of crackers. Then the conveyor moves backward at 04.00 p.m. to insert the crackers after this process then the appliance will not work anymore even if the sensor detects water, the appliance will return to work at 09.00 a.m. on the next day.

CLOSING

Based on the description of the test results measurement and analysis of automatic crackers drying machine can be concluded as follows:

Data acquisition with water intensity measurement method in rain sensor 10 times by changing the water intensity value on the sensor each test obtained results and the conclusion that at a value of 400 to 1000 with water droplets as much as 1 ml per test can activate the rain sensor, while at an intensity value of 100 to 300 with a water droplet as much as 1 ml can not activate the rain sensor.

The subsequent acquisition of data is by measuring the speed of the drying process and the return process conducted three attempts with a motor speed of 144 rpm and a drying distance of 21cm. First try to get results of drying time 0.75 seconds with a return of 0.65 seconds, a second test of drying time of 0.53 seconds with a return of 0.93 seconds and a final trial with a drying time of 0.81 seconds with a return of 0.78 seconds. It can be concluded that with a motor speed of 144 rpm and a drying distance of 21 cm requires a time of under 1 second. On the overall work of the tools performed at 09.00 a.m. to 04.00 p.m. the tool works great as the system has planned.

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