Control System Design of Automatic Roof for Chips Drying Device (Software Version)

Syifaul Fuada

Abstract— Essentially, in assembling electronic circuits is necessary designed first to the simulation. This paper is discusses about control system design of automatic roof for chips drying device using simulator (Software Version). Selection of the simulator is Wizard Circuit software, because it is easy operation (User Friendly) and more interactive, so the researcher know about voltage, current and logic circuits. In this device circuit, there are three main parts. It is Counter as a timer, control circuit and sensors (rain and light).

Index Terms— Automatic Roof, Circuit Wizard, Chips, Control System, Drying Device

1 INTRODUCTION

Chips is one of snacks version that created by steaming dough, cut thinly and dried. Chips drying process is divided to two kinds that is: (1) Conventional / Traditional, (2) Electronics. Drying using sun drying can be done. Facts indicate that at home industry in Indonesia, chips drying process usually using conventionally of drying way (sun). If using Oven have considered less economical, because the price of equipment and the cost is quite high electricity bills.

Fig 1. Konvensional Dryng Process

However, this draining way has many weakness that is, when affected by rain water chips will be damaged and not be marketable, if frying it is less for blooming. Innovations made by David Setya Gunawan (2011) entitled "*Miniatur Atap Otomatis Berbasis Elektromekanik Untuk Penjemur Kerupuk pada Home Industry*"[1].

The miniature size of 50cm x 50cm x 50cm with a DC motor as a driving force roof. The system uses an electromagnetic system, the LDR sensor to detect light in the sun & rain sensor input to the relay system. In contrast to research conducted by Ridwan Anas (2010) under the title "Design of Prototype Automatic Open Close Roofing Drying Process For Production-Based Microcontroller AT89S51" [2]. Rain sensor light sensor and fed to Microcontroller AT89S51, as well as using the LM339 as a comparator for signal processing. While research Hadi Santosa & Yuliawati (2012) with the title "Solar Energy Utilization With In The Greenhouse Effect and Fish Crackers Hair Systems in the Region Kenjeran". This tool is a working system utilizing the greenhouse effect as a dryer. The drying process takes as long as 6 hours in the dry season and when the season 3 days penghujang [3].

Differences of the research undertaken by the author lies in the substance (matter), the design of this system by the authors using a digital system which is designed and simulated using the software. Because of the assumption that the author is using a computer simulating the first step to merancangan a tool. It is intended to study the behavior of tool work in accordance with the actual object, because it's basically a computer simulation objects represent reality. With computer simulation tools workmanship is becoming easier, practical and efficient. Simulation is also a method to resolve the problem. Because of limited expectations of future software, the system design can be applied in the form of prototypes or miniature crackers basking automated tool.

2 METHOD

Boundary problem of the design of this tool are: (1) Digital Systems (carnaugh folder, boolean method, system timer), (2) sensor LDR detection of the presence or absence of light as the sun, (3) and rain sensor detection temperature as the ambient temperature, air humidity and rain droplets, (4) Motor Input A and B Motor Rotate left logic A = 1, B = 0. Motor Rotate right logic A = 0, B = 1, (5) The timer uses 2 pieces and chopped Sevensegment from 00 to 23, (6) Motor moving right (open) at the time point at 07.00 and stops when it hits the rolling door switch J2, (7) Motor moves to the left (closed) at the time point at 15.00 and roolling door stops when it hits the switch J1, (8) when the sensor is active in the span of 7:00 to 15:00 then rolling door automatically moves to the left, if the non-active sensor rolling door automatically moves to the right. The initial step in planning is to design the system. Here is a block diagram of the overall system:.

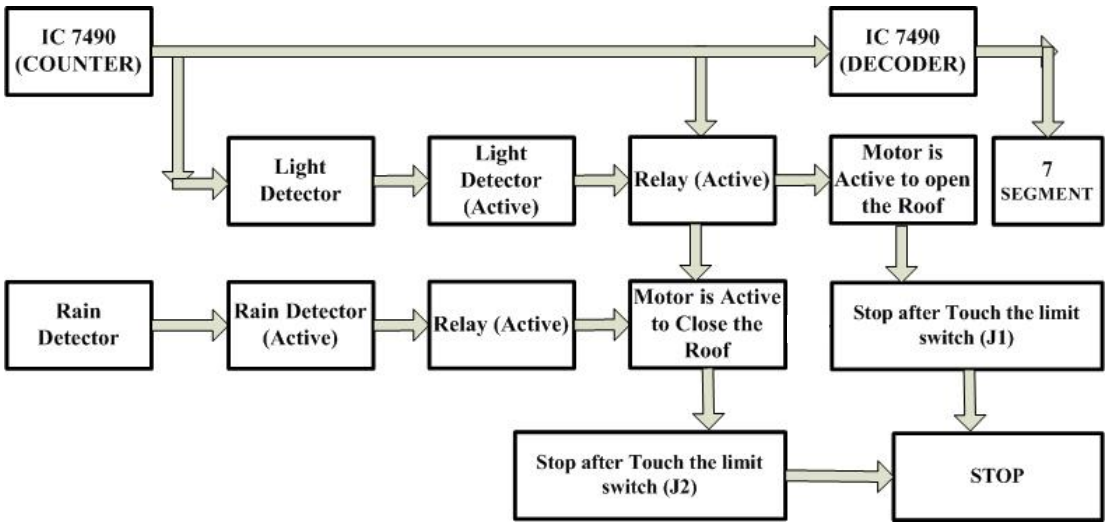


Fig 2. System design

Once the system design is determined, the next step in order is as follows: (1) design for digital clock, (2) simplification of logic gates using carnaaugh folder / Boolean Algebra, (3) motor control system design, and (4) The design of the light sensor and rain.

In implementing this system, some have to be integrated electronic circuits. Designed workflow system is as follows.

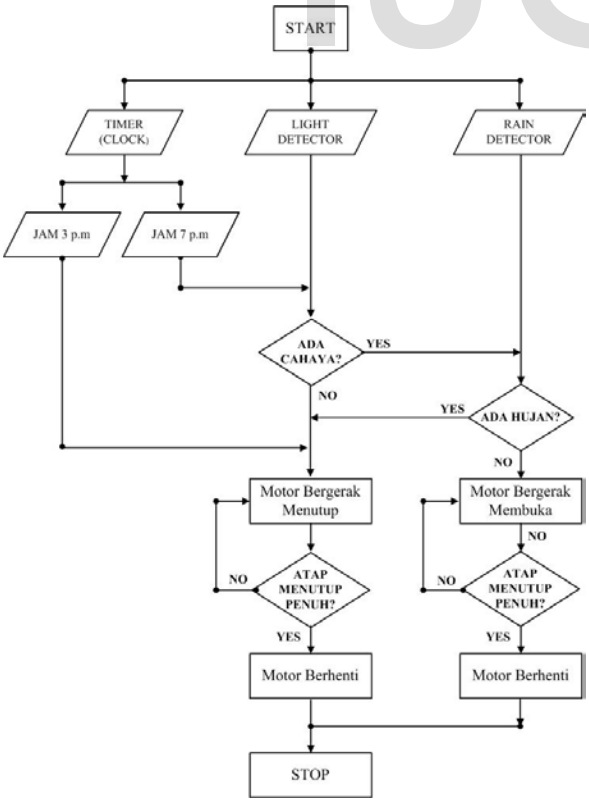


Figure 3. Flowchart System

1. The first step to analyze the problem. In this case there are four inputs that switch J1, J2, Digital Clock and Sensor. But in the analysis, the sensor used is a sensor (LDR) as input. While the rain sensor as an external tool because it can close automatically regardless of the algorithm. For more details see the following table:

Table 2. Analysis of the problem using the truth table

INPUT				OUTPUT			Indicators
A	B	C	D	X	Y	C	
CLOCK	SENSOR	J1	J2				
0	0	0	0	0	0	-	
0	0	0	1	0	0	Non Active	
0	0	1	0	0	0	Non Active	
0	0	1	1	0	0	Non Active	
0	1	0	0	0	0	Non Active	
0	1	0	1	0	0	Non Active	
0	1	1	0	0	0	Non Active	
0	1	1	1	0	0	Non Active	
1	0	0	0	0	1	-	
1	0	0	1	0	1	**CCW**	03.00 pm
1	0	1	0	1	0	**CW**	07.00 pm
1	0	1	1	0	0	-	
1	1	0	0	1	0	-	
1	1	0	1	0	0	**CCW**	Rain
1	1	1	0	0	0	Non Active	
1	1	1	1	0	0	-	

2. After getting the output data (X, Y) of the input (A, B, C, D) in the form of Clock Wise (CW) and Counter Clock Wise (CCW), the importance of the ABC logic $\overline{AB}\ C\ D + D + \overline{\overline{AB}}\ CD$. The next step is the simplification of the model into carnaugh map [4]. For more details see table 3 below:

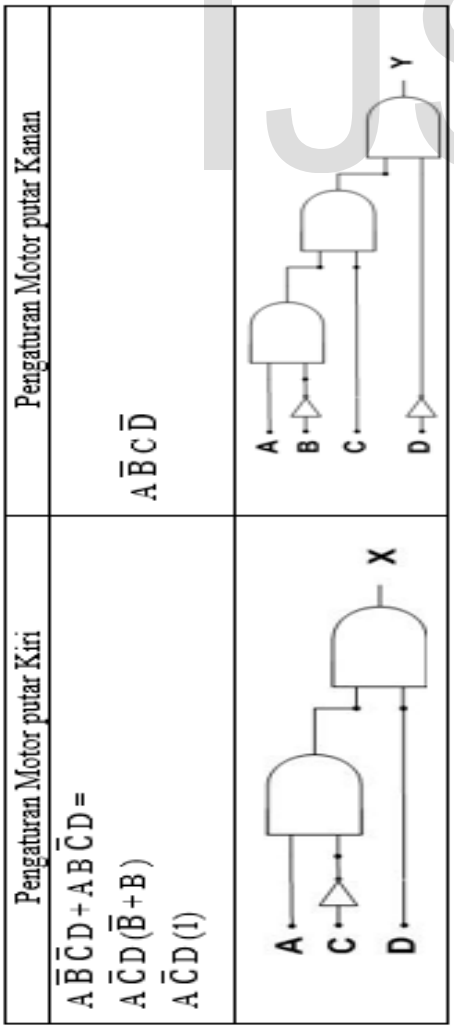
Table 3. Carnaugh Map Solution

	$\bar{C}D$	$C\bar{D}$
$\bar{A}\bar{B}$		
$\bar{A}B$		
AB	1	
$A\bar{B}$	1	1

$A\bar{C}D$ $A\bar{B}C\bar{D}$

3. Settlement can also be done with boolean algebra method [5], obtained obtained after ABC logic $\overline{AB}\ C\ D + D + \overline{\overline{AB}}\ CD$ and solved using boolean algebra, then implemented into logic gates. For more details see the following table:

Table 4. Aljabar Boolean solution



4. The fourth step is to design the system timer. On this design using a digital clock using counter IC, IC decoder and viewer sevensegment. Because only then simple simulation shown double-digit time counter. Ie from number 00 to 23. For more details see the following table:

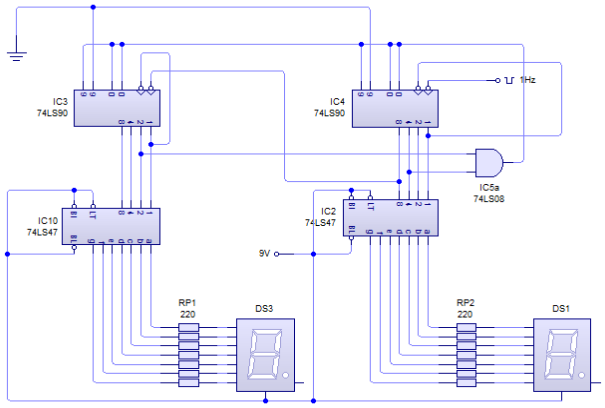


Fig 4. Timer design system

5. The fifth step the motor control design. Control using two relays to drive the motor in the roof opens and closes. Clock input comes from the open when sevensegment show number 07 and closes when sevensegment show number 15. For more details see the following picture:

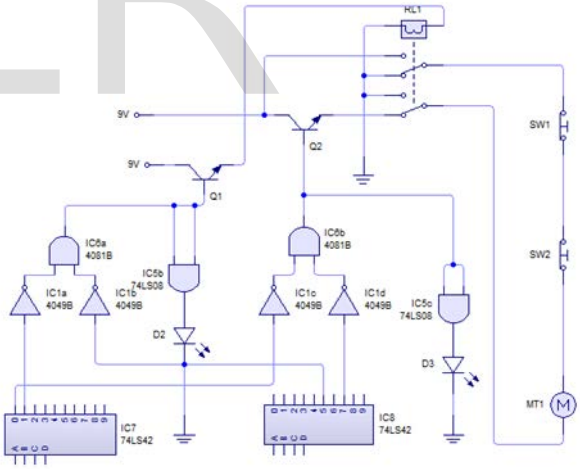


Fig 5. Motor Control design system

6. The next step the sensor design. In this case there are two sensors namely rain sensor and sensor LDR. But internal detection system using LDR as light as the tool is run. LDR is a way of working themselves if bright light conditions the resistance value can be small even touch the zero light intensity depending on the LDR. When dark conditions the resistance becomes larger [6].

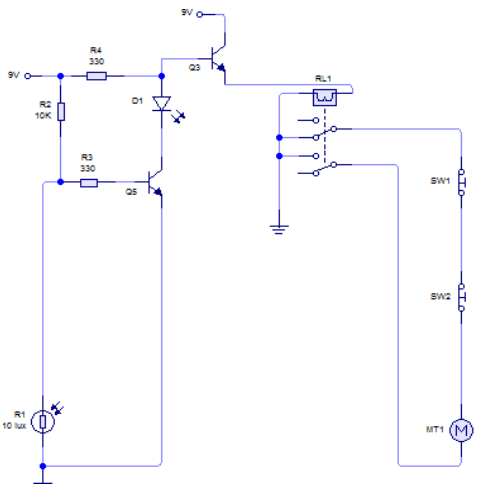


Fig 6. Motor Control design system

7. The steps above are part of the macro system of automatic control roof. So that the overall system is shown in the figure below. Appear on the current behavior of the system. User knows in real when the system off or on.

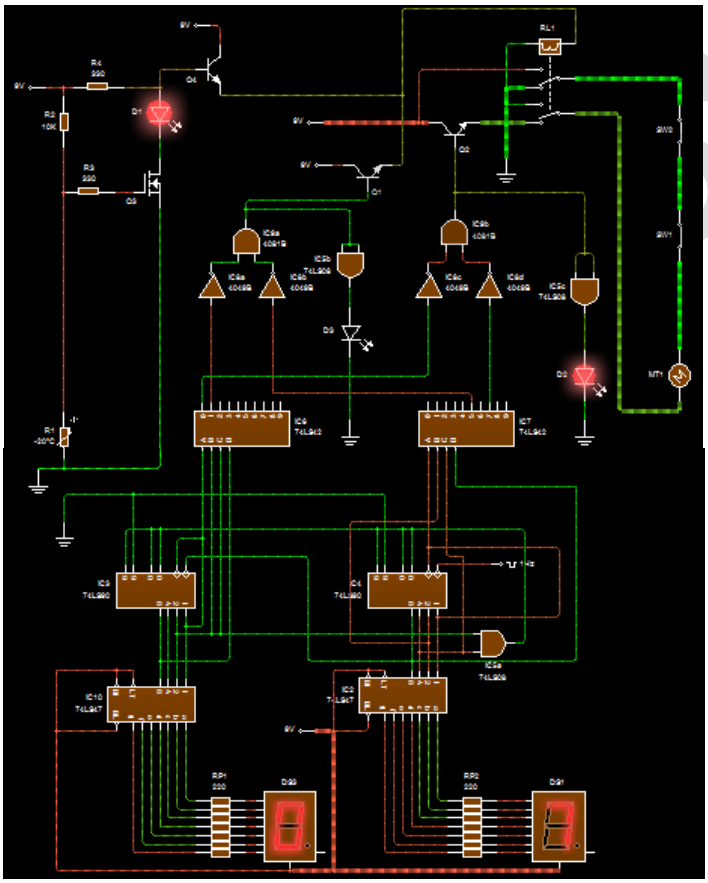


Fig 7. Design system of Automatic Roof Using Circuit Wizard Application

3 ANALYSIS

In this discussion explained the workings of the instrument as a whole. In accordance with the steps outlined in the previous section, when it is discovered that the simplification solutions using boolean algebra / Carnaugh folder, then next is the overall system design.

System analysis starts from the bottom, the timer design. Enumerators time using two sevensegment, two pieces of IC 7447 as decoders and two pieces of IC 7490 as a Counter. Output IC 7447 linked to the input sevensegment feet a - g, and IC 7447 in the input circuit to the IC 7490. At 7490 feet IC1 No2 and No3 leg IC2 is fed to the 7490 IC 7408, because the timer be set from 00 to 23 (Taken from the 0010 and 0100 of 7490 IC1 7490 IC2). So when sevensegment shows the number 23, the timer counts up from 00 again and so on.

Output IC 7408 is returned to the clock and the output of the 7490 is connected to a control circuit which consists of IC 7442 (Decoder), NPN transistors and indicators. IC1 output is connected to the input of IC1 7490 7442 (taken 7490 feet while chopping IC1 0000 and 0001), so that the output of IC1 7442 to produce numbers 1 and 0. Output is connected to the input of IC2 IC2 7490 7442, taken 7490 feet when chopping IC1 0101 and 0111, so that the output of IC2 7442 gives the figure 7 and 5. IC 7490 is a high output, so it should be in the first inverting CMOS IC mengunkan 4049B.Nilai 0 and 7 are connected to the IC1 and 2 CMOS 4049B and a value of 1 and 5 are connected to the IC CMOS 4049B 3 and 4. Then from 4049B CMOS IC's output is connected to the IC And 4081B. Thus if the counter shows 07 then the motor will move to right, and as showed 15 motor moves to the left. And Indicator consists of IC and Led, used to determine the condition 1 when the motor moves to the right or the left.

But the fact is the output of IC 4081B And it has not been able to activate the relay. Therefore mounted transistors are used as switches. And 4081B IC output is connected to the Base Feet are feet collector connected to VCC. And so if the IC 4081B in the ON condition, Transistor working and connecting to VCC 9 Volt Relay.

On the block there is also a light sensor comparators. As the name implies voltage comparator function compares the results with a voltage divider reference voltage can be adjusted as needed. Besides, it is also a benchmark on this circuit also outputs in order to determine the resulting output has only logic 0 and logic 1. Output of the comparator is connected to the Relay in series, so that when a logic 1 then the motor will rotate regardless of the clock. This is in accordance with the conditions at the time between 07.00 until 15.00 when it rains then the motor will move left (roof closed) and when the rain stops the motor back to right. In the simulation only uses switches J1 and J2 are connected in series with the motor. So that when the switch is pressed J1 and J2 motor will stop.

4 CONCLUSSION AND DESCUSSION

This paper discusses the digital system to drive the rotation of the motor on the roof of the dryer crackers under the sun. Various products have been designed before, but in my other research has differences where such differences teletak on his system. This research was limited to planning by using the software. The selected software is Circuit Wizard. This application is an interactive application and user friendly, making it very suitable when used as a simulator when designing the system. Users can see how the system works with a range of facilities such as viewer behavior of current, voltage, logic and 3 dimensions. Besides, the components of a complete enough. Users can also use the facilities of the conversion of schematic diagram to PCB layouts.

While the system is working tools briefly that there are four important variables that make up this system, the timer, rain sensor and light sensor and motor control. Roof open when the time shows at 07 and closes when the time pointing at 15. But when the rain sensor is active then the tool will close itself automatically regardless of the timer. And if the LDR sensor light mendetesi then automatically open the roof regardless of the timer. Limit switches J1 and J2 are linked on the output relay series this only serves to stop the motor if the work reaches the limit. It can be concluded that the system has been running according to plan.

As for the suggestions of the authors highly recommended to the reader as a form of improving these systems.

a. Plan in advance to simplify the circuit using boolean algebra methods or Carnaugh Map. But it is recommended to use Carnaugh Map, because it is faster in solving logic equations.
b. In designing a tool, should be in the first simulated using a computer program in order to efficiently and effectively when sistm later implemented on hardware or prototypes.
c. For the development or implementation of the system, it would be nice if using microcontroller. Thus the system timer, sensor integration, decision-making and the hardware design is more simple and ergonomic.

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5 AUTHOR'S BIOGRAPHY

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