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Article

Design and Development of a Formalin Detection Tool in Arduino Uno-Based Meatball Soup

Rendy Wiradharma [1], Endah Fitriani[2],

[1,] *Universitas Bina Darma Palembang, Fakultas Sanis Teknologi, Sumatera Selatan, Indonesia*
[2]. *Universitas Bina Darma Palembang, Fakultas Sanis Teknologi, Sumatera Selatan, Indonesia*

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E-mail: Rendywiradharma397@gmail.com

A B S T R A C T

The formalin detector is a device designed to assist in identifying the level of formaldehyde in food and beverages. Formalin is a chemical used as a preservative, but it can also be harmful to health if too much is consumed. In this design, we use the HCHO sensor as part of the formalin detection system.

The HCHO sensor works by utilizing a chemical reaction between formalin and a catalyst to produce hydroxyl and carbon monoxide. This sensor is capable of detecting the concentration of HCHO and sending an electrical signal to the control module connected to the device. The control module will analyze the signal obtained from the sensor and display the results on the LCD screen located on the tool.

This design offers an easy and efficient solution for detecting formaldehyde levels in food and beverages, so that people can ensure that the food and drinks they consume are safe from harmful chemicals.

INTRODUCTION

The Currently, the abuse of chemicals, especially in food ingredients, is very high, so it is very important for the general public to be careful when buying food. One of the triggers for people to abuse these chemicals is because the food sold is not durable and lack of knowledge about the dangers of preservatives or chemicals. One of the chemicals that is often used for food is formalin. The danger of misuse of formalin can interfere with the health of the human body and cause several diseases.

The widespread misuse of the dangerous substance formaldehyde as a preservative in food and the difficulty for the public to clearly identify the characteristics of the presence of food containing the harmful substance formaldehyde have made the community uneasy and disadvantaged. This requires a tool that can quickly and easily detect and act as an indicator for the presence of formaldehyde in food ingredients. Based on the Republic of Indonesia Minister of Health Decree No. 722 of 1988 concerning food additives, the addition of formalin to food is clearly strictly prohibited. The Food and Drug Supervisory Agency (BPOM) has the

authority to monitor the use of formalin which is used as a food preservative as stated in one of BPOM's missions, namely to protect the public from the dangers of misuse and wrong use of medicinal products, narcotics, psychotropics and other substances. addictive and risks due to the use of hazardous products and materials.

Having this detection system will help the community and other related parties easily detect the presence of formaldehyde so that no more people are harmed by irresponsible parties.

I. LITERATURES REVIEW

From research conducted by Agnesia Trivani S in 2018 who made a study entitled "Design of Formaldehyde Detector Using Grove HCHO Based on Atmega8 Microcontroller" which was made at the University of North Sumatra in Medan. As well as research from Efriansyah in 2021 entitled "Design of a Microcontroller-Based Formaldehyde Detection Tool in Fish" which was made at Muhammadiyah University of Pare-Pare in the city of Pare-Pare.

Based on the background that has been described and described from the two studies above, the authors were inspired and interested in making a tool entitled "Design and Build a Formaldehyde Detection Tool for Food Snacks in the Arduino Uno-Based Market" to be able to know and understand how to make the tool and hopefully can help people maintain a healthy body by avoiding foods that contain formalin.

II. FRAMEWORK

Diagrams are an important part of tool design. A block diagram depicts the operation of all the tools to be used, so that the total block diagram produces a system that can be used or worked on.

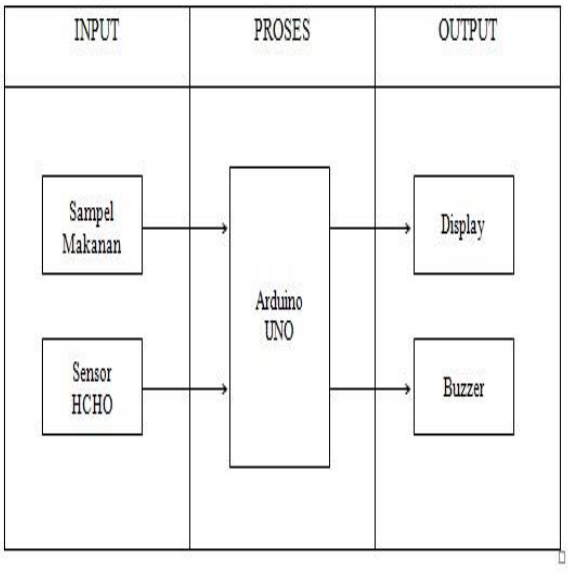

Fig 1 Block diagram

The following is an explanation of the block diagram in Fig 1 :

In the input process the food sample will be detected by the HCHO sensor and will be processed by the Arudino Uno microcontroller. And at the output of the output process is the display of the detection results from the HCHO sensor earlier to the LCD and buzzer output if the sensor detects the presence of formalin in a high value.

In addition to block diagrams, schematic circuits are also important in making tools. Schematic circuit design, like wiring, is a circuit design process.

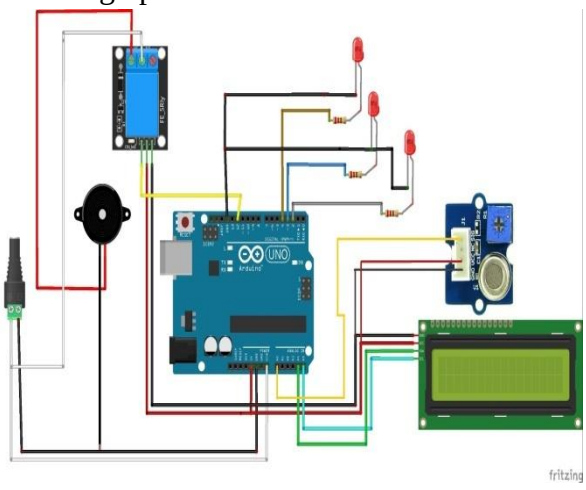

Fig 2 Schematic circuits

The following is an explanation of the schematic circuit of the tool:

12v adapter is connected to arduino uno, Pin 12 is connected to the relay, pin A0 is connected to the HCHO sensor, pins A4 and A5 are connected to the LCD

The relay output pin is connected to the buzzer.

III. METHODS

In order for the research process to run smoothly, it is necessary to have a research method that has clear research stages, which in this study was the Action Research Method. This method is a research-stage design that can explain and describe conditions for improvement purposes.

Fig 3 Method action research

The following is an explanation of the Fig. 3 Metode action research

a. Diagnosing

At this stage, the researchers conducted a survey of some of the results of previous studies as well as several reports related to formalin detection tools.

b. Action Planning

Following the survey, the researcher develops a strategy to provide appropriate problem solving.

c. Action Taking

After plans are made and scenarios designed, the researcher executes the necessary hardware or software.

d. Evaluation

At this stage the researcher evaluates the findings that can be displayed on the LCD display.

e. Learning

This stage is the final stage of the research method. At this stage the researcher monitors which food samples contain formalin and will educate them to sort food.

IV. RESULT

Fig 4 Tool view up

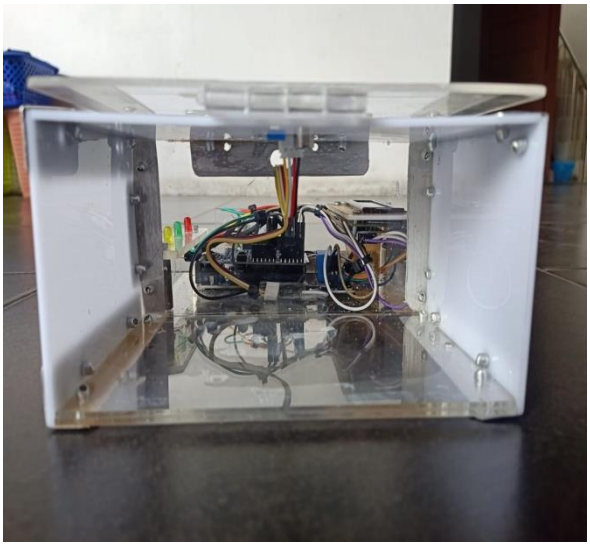

Fig 5 Side view of tools

This tool has a goal at the design stage so that during the manufacture of the tool it can work properly as expected until the end, so that the tool can be used perfectly as desired. The kit design aims to determine the layout of the components so that they can be installed correctly and in the correct order. In addition, a flowchart is needed to design this tool. The purpose of this flowchart is to describe the steps in the process by which this tool can achieve the desired result.

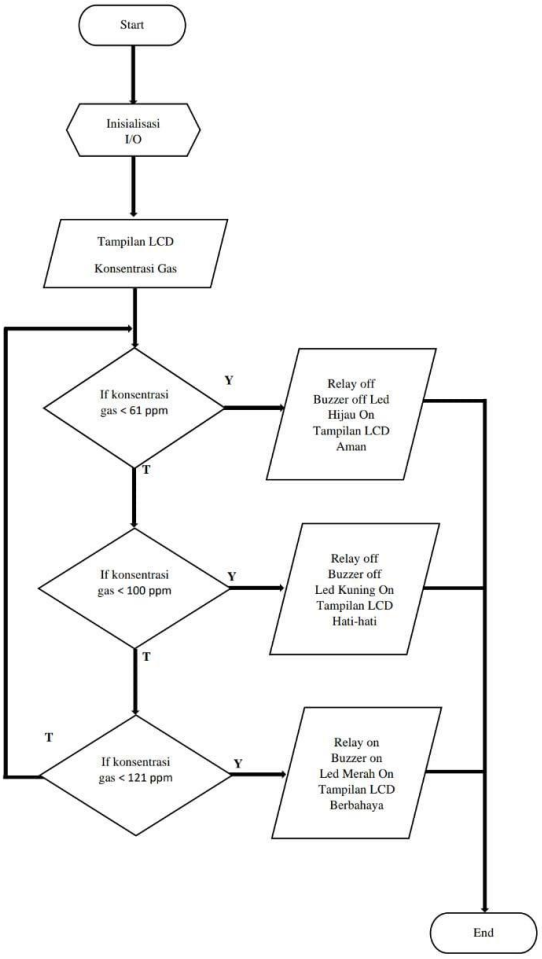

Fig 6 Flowchart

The following is an explanation of the flow chart in Figure 6:

To start the power source from the power supply to the arduino uno, then the HCHO sensor reads the formaldehyd level, and if the HCHO sensor detects formaldehyde in food, if the formalin level is detected to exceed 100 ppm then the buzzer and red led will light up. Finished.

Here's how the tool works:
connect the 12v adapter to the tool, then input the food sample to the sample section contact.

Fig 7 sample display in the box

Fig 8 Then the sensor will automatically actively detect formalin in the sample

Using the formalin with a ppm value of 108 ppm which is set on the HCHO sensor for testing this number is only for testing because the formalin level which is harmful to humans is above 100 ppm and buzzer will on.

Table

Trial to test the tool works well. Can test the text displayed on the LCD as well as a buzzer that sounds when formaldehyde is found

ForExample:

NO	Testing	Formaldehyde level (Ppm)	Green Led	Yellow Led	Red Led	Buzzer
1.	Non Formaldehyde	- (Ppm)	Off	Off	Off	Off
2.	Formaldehyde	60 – 80 (Ppm)	Off	On	Off	Off
3.	Formaldehyde	80 – 100 (Ppm)	Off	On	Off	Off
4.	Formaldehyde	100 – 120 (Ppm)	Off	Off	On	On
5.	Formaldehyde	120 – 150 (Ppm)	Off	Off	On	On

Measurement table :

NO	Posisi Pengukuran		Letak Pengukuran	Data sheet (volt)	Pengukuran (volt)	Perhitungan (volt)	Kesalahan (%)
1.	Adaptor		(TP 1)	12	12,36	12,5	0,96
2.	Arduino		(TP 2)	0 - 5	5,33	-	In Range
3.	Sensor HCHO	Mendeteksi	(TP 3)		5,09	-	In Range
		Tidak			5,09		
4.	LCD		(TP 4)	0 - 5	4,83	-	In Range
5.	Buzzer		(TP 5)	0 - 5	4,14	-	In Range
6.	Relay		(TP 6)	0 - 5	4,07	-	In Range
7.	Led Merah		(TP 7)	0 - 5	3,10	-	In Range
8.	Led Hijau		(TP 8)	0 - 5	3,10	-	In Range
9.	Led Kuning		(TP 9)	0 - 5	3,10	-	In Range

After getting the value of the measurement results, the next process is to perform calculations on the parts that can be calculated and then compared with the measurement results to find out the percentage of error.

$$\%\ eror\ \frac{data\ sheet - calculation}{data\ sheet}\ X\ 100\%$$

$$\%\ eror\ \frac{12{,}38 - 12{,}5}{12{,}38}\ X\ 100\%$$

$$= 0{,}96\ \%$$

The percentage error of this tool is 0,96 % which means the tool is working properly.

V. CONCLUSION

From the result of the implementation of the formalin detection device design in arduino uno-based meatball sauce, the authors draw the following conclusions:

The tool that was created was successfully used to detect formaldehyde content, then the tool also succeeded in displaying output values to the LCD in units (Ppm). And the buzzer will sound if the sensor detects formalin levels that exceed the safe threshold that humans can consume.

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BIOGRAPHY

Rendy Wiradharma, graduated from Methodist 2 Palembang High School, and at the time of writing this scientific journal, he was currently pursuing his undergraduate degree which is a graduation requirement at Bina Darma University Palembang.