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Design And Development Of Formalin Levels Detection In Food Based On Arduino Nano Microcontroller Using Fuzzy Method

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Abstract

Formalin is very dangerous for human health and for that we need to detect the content of formaldehyde in these foods so that this abuse should be known easily. For that we need a tool that can detect the content of formalin in food. The use of a gas sensor is the fastest way to detect formalin used in food because it does not require a chemical process that is not instant. The MQ-138 sensor is used as a formalin detection sensor in food where this tool uses an Arduino microcontroller as a processor and data processor for the MQ-138 sensor readings which then the sensor readings will be displayed on a 16x2 LCD display, and then the tool system is inputted with a fuzzy method. logic, with fuzzy logic that is safe, a little formalin, and a lot of formalin.

Keywords: Arduino, MQ-138 Sensor, 16x2 LCD, Formalin

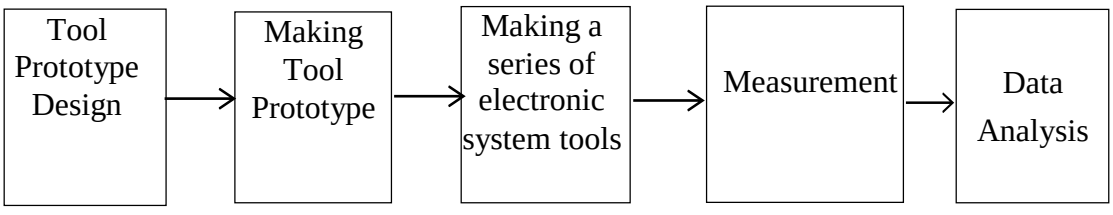
INTRODUCTION

Safe food must use additives that the government has declared safe for use in food. One of the ingredients that are prohibited from being used for food is formalin. Formalin is very dangerous for health, not only causing short-term effects, such as nausea, vomiting, diarrhea and so on, but also causing long-term effects, such as injuries to the kidneys, lungs and cancer. Formalin, with the chemical formula HCHO is a colorless, pungent-smelling solution containing approximately 37% formaldehyde in water and usually 10-15% methanol is added as a preservative.

Formalin is a hazardous material that can threaten the health of the body. The body can be exposed to formaldehyde through the digestive tract (ingestion), skin contact or inhalation. Formalin exposure can cause health problems, both acute symptoms (short term) and chronic symptoms (long term). food includes borax/boric acid, salicylic acid and its salts, diethylpyrocarbonate, dulcine, potassium chlorate, chloramphenicol, brominated vegetable oil, nitrofuranazone, and formalin.

RESEARCH METHODS

The implementation method in this research is generally divided into 5 stages which are shown by the following diagram:



Stage 1: Tool Prototype Design

At this stage the activity carried out is to design the Design of a Formalin Level Detector in Food Based on an Arduino Nano Microcontroller with the Fuzzy Logic Method using Google Sketch-up 2016 software.

Stage 2: Making Tool Prototype

The tool room is made in the form of a block of 805cm3 acrelic material. The tool used at this stage of making this space is an ordinary electric grinding machine with ordinary grinding techniques.

Stage 3: Making a series of electronic system tools

At this stage, a series of electronic system tools will be made that function to automatically acquire data obtained by the sensor into a 16x2 LCD. The stages of implementation at this stage are as follows:

a. Design circuit layout with Eagle software.
b. Print the layout on photo paper using a Z laser printer.
c. Print the printout on the PCB by heating it on the temperature of 160 0C then dissolved using FeCl2 solution.
d. Install electronic components in accordance with the paths that have been made in the circuit layout.

Stage 4: Measurement

At this stage, the distance sensor output value will be measured by providing an obstacle to the sensor and recording the results of the HCHO sensor readings.

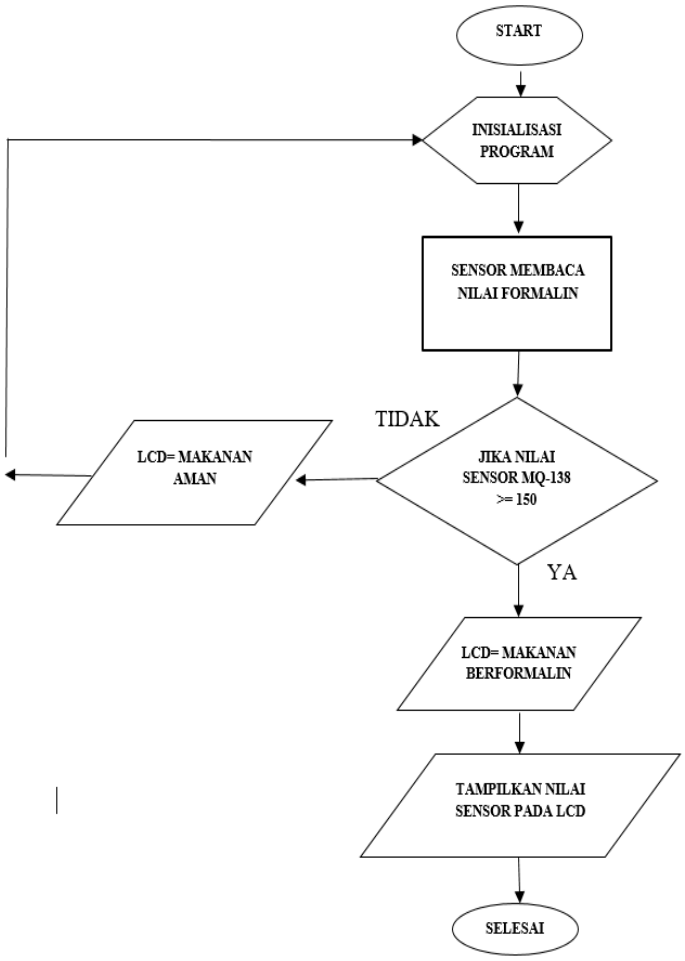
Stage 5: Data Analysis

At this stage, an analysis of the data obtained from the measurement results will be carried out. This analysis includes plotting the data in graphical form so that it can be seen and proven the accuracy of the HCHO sensor readings

RESULTS AND DISCUSSION

1. Flowchart

In this study, the researcher will explain the flowchart so that the researcher can represent the steps that must be taken in the design. According to Yatini (2010) in his book entitled "Flowcharts, Algorithms and Programming using the C++ Builder Language" is a graphical representation and steps that must be followed in completing a problem that consists of a set of symbols where each symbol represents a particular activity.



1. Start.
2. Device Initialization, this means whether the device is properly installed according to the circuit schematic.
3. The MQ-138 sensor reads the value of formalin levels in food.
4. If the MQ-138 sensor value is >150 then the LCD display = formalin food.
5. If the MQ-138 sensor value <150 then the LCD display = food is safe..
6. Display the value of the MQ-138 sensor reading on the LCD.
7. Done

1. Fuzzy Method Design

Based on the design system that will be made, there is 1 fuzzy variable that will be modeled into a membership graph, namely:

Table III.II Tool System Test Results

Sample	MQ-138 . Sensor Value	LCD Display
Ordinary food	0-80	Safe
Food + formalin a little	70-150	A little formal
Food + formalin many	140-300	formalin

To calculate the degree of membership of the input set SENSOR VALUE, a triangular curve is used with the formula:
Membership function;Membership function:

[x] = (x – a) / (b - a).

1. x=80 a=0 b=70
regular food [80] = (80–0) / (70-0)
= 80/70
= 10
Input = 80 is in the degree of membership ordinary food then the degree of membership can be determined as follows:
regular food = 80 (according to the formula if [x] = (x – a) / (b - a) then the value Then input 80 is regular food

2. x=150 a=70 b=140
food+a little formalin [150] = (150–70) / (140-70)
= 80/70
= 10
Input = 150 is in the degree of membership food + formalin a little then the degree of membership can be determined as follows:
food+a little formalin = 150 (according to the formula if [x] = (x – a) / (b - a) then the value Then input 150 is food+a little formalin

3. x=300 a=150 b=140
food+formalinlots [300] = (300–140) / (300-150)
= 160/150
= 10

Input = 300 is in the degree of membership food + formalin many then the degree of membership can be determined as follows:
food + formalin a lot = 300 (according to the formula if [x] = (x - a) / (b - a) then the value Then input 300 is food + formalin a lot.

CONCLUSION

After carrying out the design and manufacture stages of the system which is then continued with the testing and analysis stage, the following conclusions can be drawn:

1. Arduino Nano functions as a controller, data receiver, and data processor in the system for detecting formalin levels in food.
2. In the application of a tool to detect formalin levels in food, it can be concluded that if the food does not contain formalin, the sensor value is MQ-138 0-70 then the LCD display = Safe, if the food is given a little formalin, the sensor value is MQ-138 60-140, then the LCD display = a little formalin. , and if the food is given a lot of formalin the sensor value is MQ-138 130-300 then the LCD display = Lots of Formalin.
3. The working principle of the HCHO sensor in the tool system is to detect formalin levels in food.

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