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ERROR DETECTOR SYSTEM DESIGN ON PCB COMPONENT INSTALLATION BASED ON ARDUINO UNO MICROCONTROLLER

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Abstract
This study aims to make a physical design of a room temperature detector using an LM35 sensor with DFRduino Uno V3.0 based on Liquid Cristal Display (LCD), to find out the Java programming language which is arranged to command the components of the instrumentation circuit and to know the temperature results detected by the instrumentation circuit. LM35 sensor from a tool that has been made and compares with a room temperature thermometer. The PCB installation error detector is designed to determine the temperature in a room and is displayed on the Liquid Crystal Display (LCD). The temperature signal around the room will be detected by the LM35 sensor where the LM35 sensor detects a signal in the form of a voltage. The signal is processed into a digital signal using the Java language which is listed in the code on the Arduino Software. Temperature signal processing using DFRduino UNO V3.0 produces more accurate detector results. Using the LM35 sensor and DFRduino UNO V3.0 the average room temperature using a room detector was (29.15 ± 0.5oC) and an analog thermometer (29.23 ± 0.5oC). From the difference in the values of the two measuring instruments, it is found that the % error range of the designed detector is 0.27%, the temperature range that is accurately detected is at 28-31oC. The design of the PCB installation error detector is equipped with a security system using a keypad as a password switch. Based on the detector design results, it is known that the LM35 sensor works well and provides accurate temperature information.

Keywords:*Sensor LM35, DFRduino UNO V3.0, liquid crystal display*.

A thermometer or what we know as a temperature detector is a tool commonly used as a reference tool for measuring temperature in various fields. This tool is widely used and still exists in the community because of its high measurement accuracy. With advances in technology, many people are processing this analog measuring instrument into a digital measuring instrument.

The IC LM 35 temperature sensor is an IC chip produced by National Semiconductor which functions to determine the temperature of an object or room as an electrical quantity, or it can also be interpreted as an electronic component that functions to change the temperature. obtained by changing the electric quantity. IC temperature sensor

LM35 can convert temperature changes into output voltage changes. The temperature sensor IC LM35 requires a constant voltage source of +5 volts DC power consumption in 60 operations.

The LM35 sensor works by converting temperature into voltage. The ideal output voltage of the LM35 is 100 °C which is equivalent to 1 volt. This sensor has a self-heating of less than 0.1 ° C, can be operated through a single power supply can be connected to a very easy control connection interface. IC LM 35 as a detailed temperature sensor is packaged in the form of an Integrated Circuit (IC) where the output voltage is very linear with changes in temperature.

The LM35 sensor changes from physical temperature to a voltage of 10 mV/°C, which means an increase in temperature of 1°C will result in a voltage increase of 10 mV (Zennifa, 2012).

Sensor system development sensors must choose the appropriate measurement principle, special measurements must be developed to improve sensor capabilities, because the optimal combination of signal

processing system technology (Wirawan) is required to obtain optimal sensor or sensor system capabilities. , 2011).

Based on Lucky Yuditia Putra's research, the AC temperature measurement automation system is a very useful system for human life. It is hoped that this system can make it easier to find out the room temperature. LM35 is used in research as a sensor that is very sensitive to temperature.

The results of the LM35 sensor are processed by Arduino Uno, which are then displayed on a desktop application using C# .Net which is stored in the database. Room temperature measurement results can be changed very easily. Therefore, the results of the AC temperature measurement are displayed on the desktop application, especially in this study, the measurement results are often unstable, measurement errors occur. This may be caused by some unstable input voltage values (Putra, 2013).

according to (Setiawan, 2017), Arduino-Uno is designed to be transformed as a microcontroller that is ready to use, programming and I/O are available so that Arduino makes a board that is easy to use and program because it is supported by the C language. The Arduino-uno brain uses an ATMega8, ATMega168 or ATMega328 Microcontroller Chip, Broadly speaking, the use and number of feet of the microcontroller is the same, it's just that the difference is the storage power / memory.

Figure 1. Arduino Uno Display
(Source: (Setiawan, 2017))

according to Wirawan, (2018), Bluetooth is a wireless communication tool that works on a 2.4 GHz radio frequency in exchanging data on mobile devices such as PDAs, laptops, cellphones, and other devices. For example, the most widely used Bluetooth module is the HC-05' type. The HC-05' Bluetooth module is one type of Bluetooth module that can be found in the market at a relatively affordable price. The HC-05 Bluetooth module is composed of 6 pin connectors, each of which has a different function. Bluetooth module HC-05 which has a supply voltage of 3.3 V to pin 12 of the Bluetooth module as VCC. Pin 1 in the Bluetooth module is the transmitter. Then pin 2 on Bluetooth is the receiver.

The following is a picture of the HC-05 Bluetooth module which can be seen in Figure 2.:

Figure 2. *Bluetooth Module HC-05*
(Source: (Wirawan, 2018))

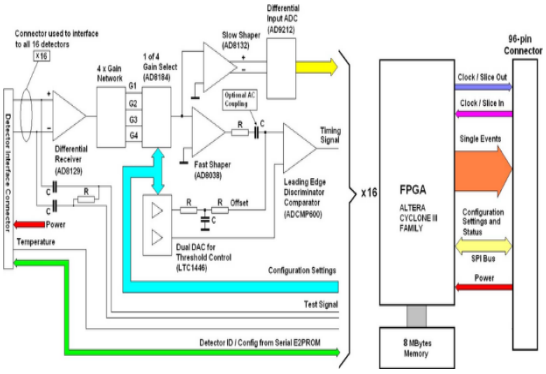
2. Research method

Research, including assembly testing, will be carried out at PT SIIX ELECTRONICS INDONESIA for 2 months.

B). Material Tools:

Arduino uno v3.0, LM35 IC temperature sensor, Java Driver software, Notebook, Controller power supply, USB port cable, 2x16 LCD, Fan, Keypad, Pin head material resistance, Potentiometer, Switch, Transistor, Reset switch.

C). Detector design block diagram



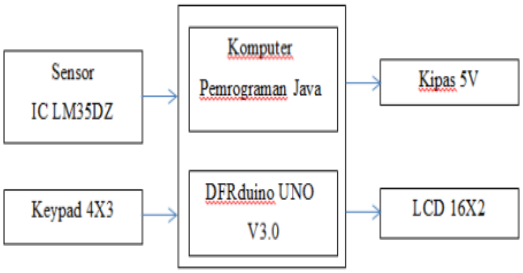


Figure 1. Detector design block diagram

D). Data analysis

1) Data analysis steps, in particular:
2) The first test will be carried out with the LM35 sensor accuracy test.
3) The LM35 sensor is a sensor that can measure temperatures from -55 °C to 150 °C (only temperatures from 0 °C to 50 °C will be used in this study).
4) 2). This sensor accepts inputs from 1 V to 5 V and has an output of 10 mV at 1 C. The output of this sensor is the input of the DFRduino analog pin, which will be calculated to display the actual temperature.

T = (Va x Vb x 100.0) / 1024.0:
where:
T = actual temperature
Va = LM35 of Vin . output
Vb = Vin Arduino:

2) The data received from the Java program will be recorded in the form of an LCD screen.

3) The temperature obtained manually is compared with the room thermometer parameters.

4. Discussion results

Research result:

The PCB mount fault detection system consists of a device that detects room temperature using the DFRduino Uno (Atmega328P), LM35 temperature sensor, keyboard, LCD fan.

The device system used in this room temperature detection system uses Arduino Uno software which is used as an error detection program that can be measured many times.

This research uses Java as the programming language. Java is an object-oriented programming language whose syntax traces back to the CC++ language so that C programmers have no trouble moving to Java, because the syntax is almost the same as the language.

Another advantage of Java is that it is easy to use, Java is a multi-platform programming language, Java supports another commenting style known as javadoc, Java also uses new commands that C language does not have.

The gadget starts by plugging in a 9V battery to activate the DFRduino Uno device as the gadget's main system. Initial display The first time the detector is turned on, the tool will display a description of the detector, then the detector will ask you to enter a password that measures the room temperature, then provide information on re-measurement of the engine (fan) on / off.

The detector test results were obtained at room temperature in oC. The figure below shows the results of measuring the temperature of the test room using a designed analog detector chamber thermometer. The test is carried out every five minutes tested for one hour. Analog thermometer detectors are placed side by side the room temperature is measured simultaneously.

Figure 2. Test the detector with an analog room thermometer

Data from the test results of the analog detector with the analog thermometer under test are given performed in an unheated room.

Table 1. Detector test results with analog thermometer

No	Waktu	Pengukuran Suhu		
		Detektor (°C)	Termometer Analog (°C)	Error
1	12.03	29	29	0
2	12.08	29	29	0
3	12.13	30	30	0
4	12.18	28	29	3,4%
5	12.23	29	29	0
6	12.28	30	29	3,4%
7	12.33	28	29	3,4%
8	12.38	29	30	3,4%
9	12.43	31	29	6,8%
10	12.48	29	30	3,4%
11	12.53	29	29	0%
12	12.58	30	29	3,4%
13	13.03	28	29	3,4%

The test results are obtained by designing the error detector percentage with the actual instrument, which is 0.27%. The table below shows the comparison results of heating detectors and analog room thermometers.

Table 2. Analog thermometer heating detector comparison results

No	Detektor (°C)	Termometer (°C)
1	28	28
2	29	29
3	31	31
4	32	34
5	33	36
6	35	38
7	37	40
8	37	42
9	37	44

The table above shows the room temperature comparison between analog thermometer B PC PCB fault detection installation which is heated periodically in an open room to show the detected temperature difference. The following equation can be used to calculate the detector to analog thermometer ratio:

$$r = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{\{n\Sigma x^2 - (\Sigma x)^2\}\{n\Sigma y^2 - (\Sigma y)^2\}}}$$

$$r = \frac{9.10854 - (299)(322)}{\sqrt{\{9.10081 - (299)^2\}\{9.11832 - (322)^2\}}}$$

Obtained:

R = 0.979:

The thermometer detector ratio is 0.979. The exact temperature range detected by the detector is 28-31 C.

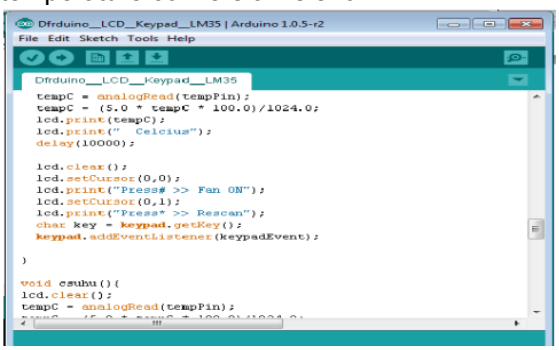
The working principle of the LM35 sensor will be sensory, when the temperature changes at every 1 C temperature it will show a voltage of 10 mV. Ambient temperature signal will light up

Detection by the LM35 sensor, where the LM35 sensor detects a signal in the form of a voltage. Signals sent to Dfrduino uno are processed according to order. The signal, which was developed in the Dfrduino uno, will be sent and displayed directly on the LCD.

Based on the data obtained from the measurements, the average room temperature using a heat detector is 29.15oC, and an analog thermometer is 29.23oC. The difference in the values of the two measuring instruments is obtained with an error range of 0.27% from the designed detector. Based on the description above, temperature measurement through the LM35 DFRduinoo UNO V3.0 temperature detector can be used as a temperature measuring instrument in general.

The design of the PCB installation error detector is equipped with a security system using a keyboard. If the detector user enters the wrong password, the detector does not work as a temperature meter. When this happens, the detector restarts automatically from scratch asking the user to enter the correct password. In addition, the keyboard also functions as a button to repeat measurements, to turn on/off the engine (fan) on the detector.

Dfrduino uno v3.0 programming sketch for temperature conversion is shown.



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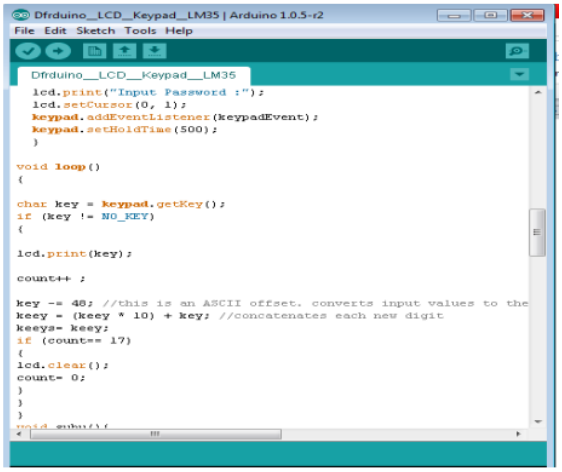

The results above prove that the room temperature detector using the LM35 sensor with DFRduino UNO V3.0 is more accurate than the results of previous studies, all components work well.

Judging from the review/control of the information system, the designed detector has a narrow control area where the user has to control the detector manually. The detector also has a weakness in the notification system where increasing or decreasing the detector design temperature is not available.

The design of a room temperature detector has limitations in its design, especially when checking the LM35 temperature sensor component can detect the temperature in decimal horses, in this case each component is tested on Arduino software when all components are tested. designed, the detector displays only integers.

5.Conclusion Recommendations

Based on the results of the study of room temperature detectors using the DFRduino UNO V3.0 LM35 sensor, it is concluded:

a) Physical design of room temperature detector using LM35 sensor based on DFRduino UNO V3.0 LCD. Various designed room temperature detectors
b) works well in the language that composes it.
c) Using the Java language compiled in the Arduino sketch in the programming language, so that the detector can perform functions according to research needs.
d) The average temperature of the room detector with the LM35 DFRduino UNO V3.0 sensor is 29.15oC, and the analog thermometer is 29.23oC. The difference in the values of the two measuring instruments shows that the % error range of the designed detector is 0.27%. The design of the room temperature detector is equipped with a security system, using the keyboard as a password switch.

6. Suggestions

Based on the results of data processing based on the LM35 DFRduino UNO V3.0 sensor to detect room temperature data processing, researchers provide information for further research.

a) The room temperature detector design should be added to the remote control system.
b) The design of a room temperature detector should be added to the notification system as an indicator of temperature changes.

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