

Temperature and Water Level Monitoring System at the Entry of Electronic Engineering Laboratory

Yoice R. Putung
Electrical Engineering Dept
Manado State Polytechnic
North Sulawesi - Indonesia

Josephin Sundah
Electrical Engineering Dept
Manado State Polytechnic
North Sulawesi - Indonesia

Sukandar Sawidin
Information Technology Dept
Manado State Polytechnic
North Sulawesi - Indonesia

Ventje F. Aror
Electrical Engineering Dept
Manado State Polytechnic
North Sulawesi - Indonesia

ABSTRACT

During this Covid-19 pandemic, devices for detecting human body temperature and hand washing water are very important so that we can avoid the spread of Covid-19.

This study aims to make a Body Temperature Monitoring System and Water Level in the form of a prototype. Using the JSN-SR04T (Ultrasonic Distance Waterproof) Sensor to measure the water level and the MLX90614 Sensor (Non-Contact Temperature Sensor) with the Arduino Uno controller. Information from the height of the water level in the tank and the temperature of the human body can be monitored via the LCD.

The method used is the Prototype Design Method starting at the stage of literature study and data collection. The software and hardware design was continued for the need for measuring the water level and temperature. Next is the stage of making the control system on the prototype, then the testing stage.

The test results If the water level level is High, the water level indicator is Green, the water level is Medium, the water level indicator is Yellow and when the water level is Low the indicator is a Red led light. informs that the water in the tank must be filled.

If the temperature of the human body is $< 37^{\circ}\text{C}$ LCD display Temperature is normal, but if the temperature $\geq 37^{\circ}\text{C}$ LCD display Check to a doctor because there is a risk of contracting Covid 19.

General Terms

Body Temperature, Water Level

Keywords

Arduino Uno, LCD, Sensor JSN-SR04T and MLX90614

1. INTRODUCTION

During this Covid-19 pandemic, it is very important for us to take care of our health, especially regarding hand hygiene and body temperature. As is well known, it is an appeal from the government for us to maintain cleanliness and health by washing our hands often, if we leave the house we must wear a mask, keep our distance from other people so as not to transmit the Covid-19 disease.

The problem is, in accessing the information on the Water Level in the tank, it cannot be known because of the lack of quick monitoring whether the water is still there or has run

out and body temperature measurements for lecturers and students still use temperature gauges with thermometers that are in direct contact with officers who are held alternately. by officers and may come into contact with other officers who, without us knowing, may already have Covid-19. Based on the problems stated above, we need a system that can monitor body temperature and water level in the hand washing water storage tank, so a design for a Temperature and Water Level Monitoring system will be made at the Entrance of the Laboratory of the Electrical Engineering Department using the Arduino Uno Microcontroller control.

2. LITERATURE REVIEW

2.1 SENSOR JSN-SR04T

JSN-SR04T (Ultrasonic Distance Waterproof) is an industrial standard ultrasonic module with waterproof capability and high measurement accuracy. JSN-SR04T is a developed version of the ultrasonic module HC-SR04 but with the addition of a waterproof feature.



Figure 1. Sensor JSN-SR04T

2.2 SENSOR MLX90614

The MLX90614 sensor is a sensor used to measure temperature by utilizing infrared radiation. The MLX90614 sensor is specially designed to detect infrared radiation energy and has been automatically designed so that it can calibrate infrared radiation energy into a temperature scale. The MLX90614 consists of an infrared thermopile detector MLX81101 and signal conditioning ASSP MLX90302 which is used to process the output of the infrared sensor. The thermopile consists of layers or membranes made of silicon and contains a lot of thermocouples so that infrared radiation coming from the object will be captured by the membrane.

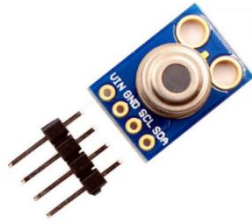


Figure 3. Sensor MLX90614

2.3 Arduino Uno Microcontroller

Arduino Uno with ATmega328P has 14 digital inputs/outputs (6 of which can be used for PWM output), 6 analog inputs, 16 MHz clock speed, USB connection, power jack, ICSP header, and reset button. Arduino Uno ATmega328P schematic.



Figure 4. Skema Arduino Uno

2.4 Liquid Crystal Display(LCD)

LCD is an electronic circuit that is used to display information or indicators given to the microcontroller. The LCD used is a dot matrix LCD with a character count of 2 x 16. The LCD is very functioning as a viewer which will later be used to display the working status of the tool.



Figure 5. Liquid Crystal Display

2.5 I2C LCD

I2C LCD is an LCD module that is controlled serially synchronously with the I2C/IIC (Inter Integrated Circuit) or TWI (Two Wire Interface) protocol. LCD modules are normally controlled in parallel for both the data and control lines. The I2C converter module shown in Figure 5 uses the ICPCF8574 chip from NXP as the controller. This IC is an 8 bit I/O expander for the I2C bus which is basically a shift register.



Figure 6. I2C LCD

3. METHODOLOGY

In this study, the design method is used which begins with making a block diagram of the system and the design of the Temperature and Water Level Monitoring System. Sensor MLX90624 (Non-Contact Body Temperature Sensor) to detect Human Body Temperature and then processed by the microcontroller the results to be displayed on the LCD.

The designs carried out are: Making block diagrams of control systems, designing power supplies, Relay Drivers for System On/off, JSN-SR04T Sensors, MLX90624 Sensors, Indicator Lights using Arduino Uno microcontroller, Lamp Loads and Monitoring with LCD as well as control system testing integrated to simplify the hardware manufacturing process.

The stages of the research are described as the block diagram in Figure 7. below:

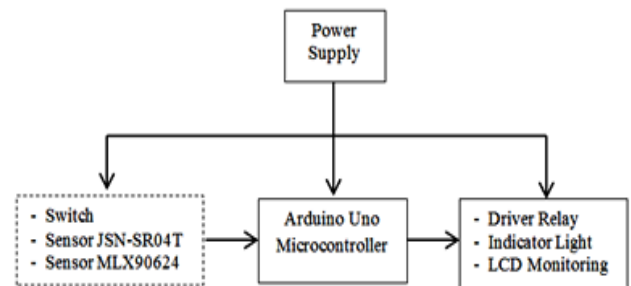


Figure 7. System Block Diagram

Description of block diagram:

1. Designing a power supply for Sensors, Arduino Uno, Relay Drivers and LCD monitoring tools.
2. Designing the ON/OFF Power Supply indicator switch.
3. Designing the JSN-SR04T (Ultrasonic Distance Waterproof) Sensor to detect the Water Level in the tank.
4. Designing Sensor MLX90624 (Non-Contact Body Temperature Sensor) to detect Human Body Temperature.
5. Implementation of the Arduino Uno Microcontroller as a central control system that functions to receive data from sensors, and process the data.
6. Designing LCD (Liquid Crystal Display) and Indicator Lights (Led) for system monitoring.
7. Connecting the Lamp Loads with the control system through the Lamp Driver.

3.1 Research Model and Design

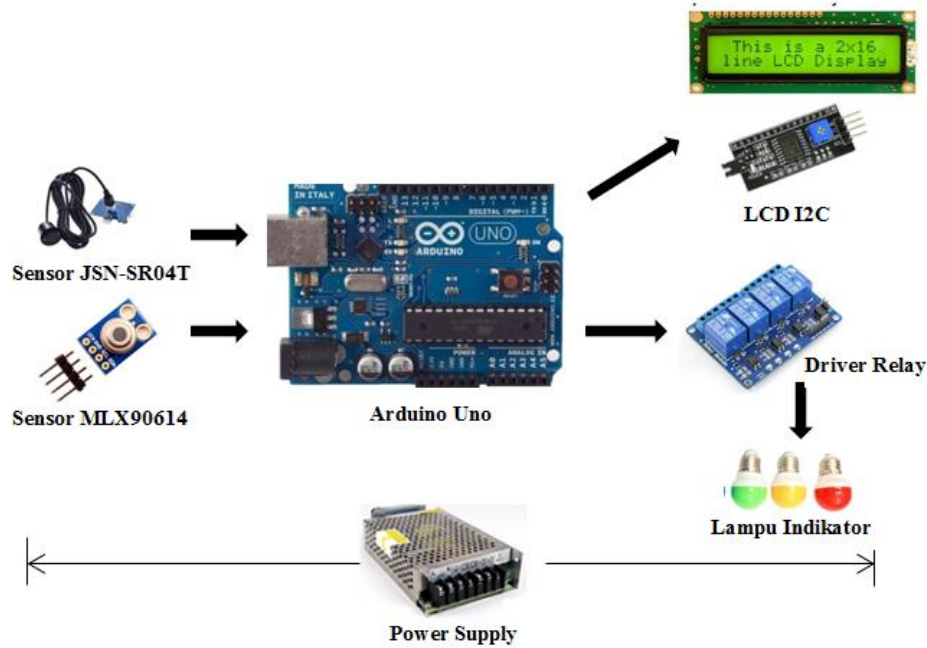


Figure 8. Temperature and Water Level Monitoring System

How the System works:

When the system is activated, the Arduino Uno Microcontroller will detect a signal from the JSN-SR04T (Ultrasonic Distance Waterproof) Sensor to detect the Water Level in the tank and the MLX90614 Sensor to detect human body temperature (Non-Contact Body Temperature Sensor). Next processed Arduino Uno.

If the water level is High, the indicator is Green, the water level is Medium, the indicator is Yellow, and when the water level is Low, the indicator is Red, which informs you that the water in the tank must be filled.

If the temperature of the human body is $< 37^{\circ}\text{C}$ LCD display Temperature is normal, but if the temperature $\geq 37^{\circ}\text{C}$ LCD display Check to a doctor because there is a risk of contracting Covid 19.

4. FLOW CHART SYSTEM

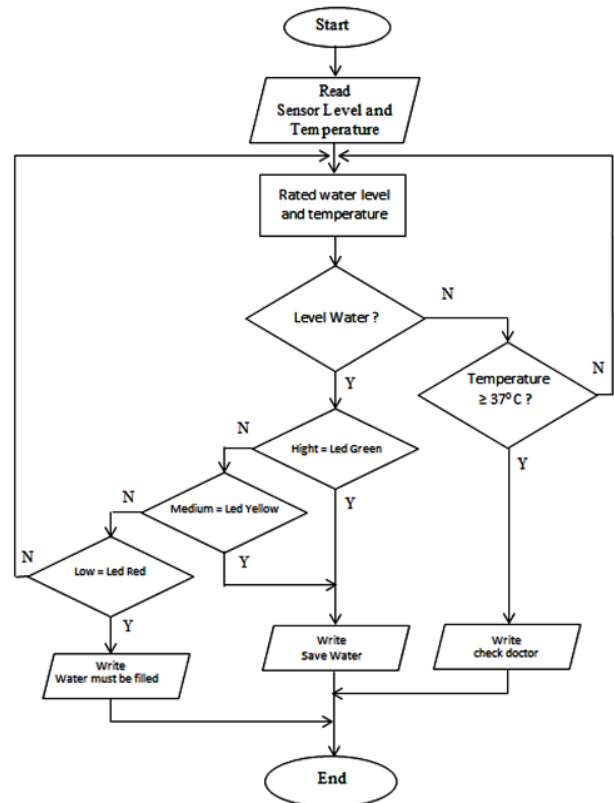


Figure 9. Flow Chart System Temperature and Water Level

System Block Diagram Description:

1. Activate the system
2. Read Sensor Signal Level and temperature.
3. Shows Air Level and Temperature Value.
4. If the water level is high (full) then the green led light is on.
5. If the water level is (Medium) then the yellow led light is on, water needs to be added.

6. If the water level is low, the led light is red, water must be added.
7. If the detected temperature is equal to or greater than 37⁰C then consult a doctor.

5. RESULTS AND DISCUSSION

In this section, we will discuss the test steps which include testing the JSN-SR04T (Ultrasonic Distance Waterproof) Sensor circuit, MILX90614 Sensor (Non-Contact Temperature Sensor), Arduino Uno Microcontroller, testing the I2C LCD circuit, testing the relay driver circuit for on/off. indicator led light.

5.1 Circuit Driver Relay Test

Testing the relay driver for on/off lamps is carried out to test the magnitude of the input voltage, base current and relay voltage when the circuit is active. Figure 10. shows a test of the relay driver circuit for on/off lamps.

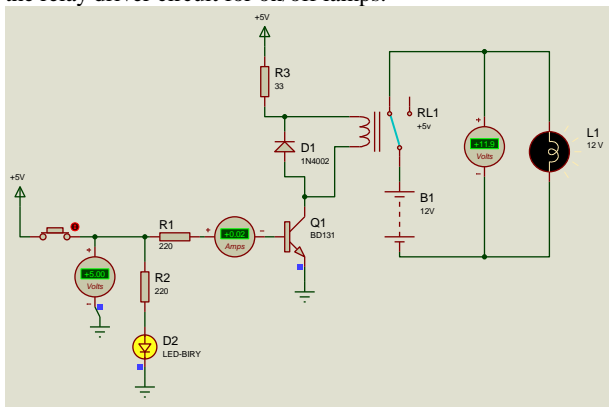


Figure 10. Testing the Indicator Light Driver Circuit

When the push button is pressed, the current will pass through the resistance R1 and R2, because the resistance R2 is installed with a led and connected to neutral, the LED light as an indicator will light up. And the current that passes through R1 will enter through the base of the transistor so that the collector and emitter are connected. The transistor functions as a switch so that the relay works and the DC current can be connected to the 12 Vdc indicator light load and the indicator light is on.

5.2 LCD Display Test

LCD testing was carried out using an Arduino Uno microcontroller as a control to run the program displaying characters on the LCD. The program is made using the C language program with Arduino 1.0.6 software.

Listing of LCD programs as follows:

```
#include <Wire.h>
#include <Adafruit_MLX90614.h>
#include <LiquidCrystal_I2C.h>
Adafruit_MLX90614 mlx = Adafruit_MLX90614();
#define I2C_ADDR 0x27
LiquidCrystal_I2C lcd(0x27, 16, 2);
void setup() {
  lcd.begin(16,2); //inisialisasi LCD

  // initialize the LED pin as an output:
  pinMode(ledPin, OUTPUT);
  // initialize the pushbutton pin as an input:
```

```
pinMode(buttonPin, INPUT);
}
void loop() {
  temp_obj = mlx.readObjectTempC();
  temp_obj = temp_obj + 3;
  digitalWrite(TRIG, LOW);
  delayMicroseconds(2);
  digitalWrite(TRIG, HIGH);
  delayMicroseconds(20);
  digitalWrite(TRIG, LOW);
  float distance = pulseIn(ECHO, HIGH,26000);
  distance = distance/58;
  Serial.println(String(temp_obj) + " " +
String(distance));
  if(temp_obj> 37) {
    lcd.clear();
    lcd.setCursor(0,0);
    lcd.print("Suhu : ");
    lcd.setCursor(0,1);
    lcd.print(temp_obj);
    lcd.print(" *C");
    delay(6000);
    lcd.clear();}
  else {
    digitalWrite(8,LOW);
  }
  lcd.setCursor(0,0);
  lcd.print("Suhu:");
  lcd.setCursor(7,0);
  lcd.print(temp_obj);
  lcd.print(" *C");
```

After the program is completed and verified there is no syntax error in the program, the program is uploaded so that it obtains the program used to run the microcontroller. The results of the program on the LCD as shown in Figure 11. Below.



Figure 11. Temperature display below 37⁰ C

5.3 Water Level Test

Testing the water level in the water reservoir (tank) is carried out using the Arduino Uno microcontroller as a control of the water level to control whether the water is still full, half filled (medium) or low (low) with a LED light indicator. If the distance of the JSN-SR04T level sensor is less than or equal to 25 cm then the green LED will light up indicating the water is full in the tank. then the red indicator LED lights up. The program is made using the C language program with Arduino 1.0.6 software.

Listing of Water Level Control program as follows:

```
if (distance <= 25){
  digitalWrite(ledfull,HIGH);
  digitalWrite(ledmedium,LOW);
  digitalWrite(ledlow,LOW);
}
```



```

else {
digitalWrite(ledfull,LOW);
}
if (distance >= 25){
digitalWrite(ledmedium, HIGH);
digitalWrite(ledlow,LOW);
}
if (distance >= 35) {
digitalWrite(ledlow, HIGH);
digitalWrite(ledmedium, LOW);
}
delay(300);
}

```

The results of the program on the water tank as shown in Figure 12 below:

In the picture shows the green indicator LED lights up indicating the water in the tank is still full.



Figure 12. Testing Water Level with Led Indicator

The test is carried out by filling water into the tank as high as 25 cm from the sensor distance, and reducing the water level by 1 cm gradually until the sensor distance with the water surface is 35 cm, from the measurement results can be seen in Table 1, that the JSN-SR04T Distance sensor reads the distance from sensor to the water surface.

Table 1. Testing the JSN-SR04T Distance Sensor with Water

No.	Water Level	Distance Sensor with Water (cm)	Indicator LED Lights
1	High	25	Green
2	Medium	26	Yellow
3	Medium	27	Yellow
4	Medium	28	Yellow
5	Medium	29	Yellow
6	Medium	30	Yellow
7	Medium	31	Yellow
8	Medium	32	Yellow
9	Medium	33	Yellow
10	Medium	34	Yellow
11	Medium	35	Yellow
12	Medium	34	Yellow
13	Low	35	Red

5.4 Monitoring System Test Temperature and Water Level

Tests are carried out to determine whether the function of each component of the tool is in accordance with the flowchart that has been made, so that improvements can be made to obtain results that are in accordance with the design of both hardware and software.

When the system is activated, the Arduino Uno Microcontroller will detect signals from the JSN-SR04T (Ultrasonic Distance Waterproof) Sensor to detect the Water Level in the tank and the MLX90614 Sensor to detect human body temperature (Non-Contact Body Temperature Sensor). Next processed Arduino Uno,

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If the human body temperature $< 37^{\circ}\text{C}$ LCD display Temperature Normal, but if the temperature $\geq 37^{\circ}\text{C}$ LCD display Check to a doctor because there is a risk of contracting Covid 19.

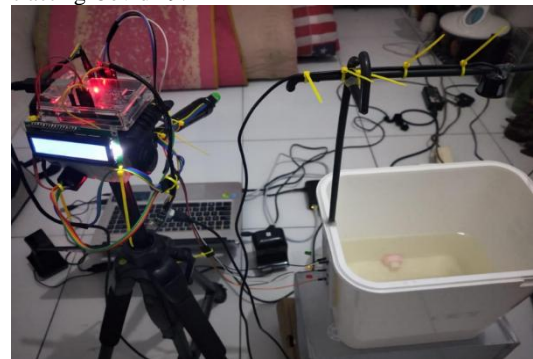


Figure 13. Temperature and Water Level Monitoring System

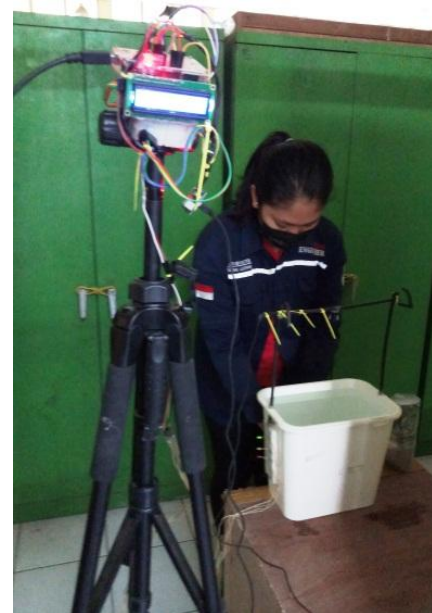


Figure 14. Water Level Test

In figure 14. when students are about to enter the laboratory, they are required to wash their hands or use a hand sanitizer, the Green LED light indicator shows that the water is still full. Then check the body temperature (figure 15) if the body

temperature is $< 37^{\circ}\text{C}$ can enter the laboratory, if the body temperature is $> 37^{\circ}\text{C}$ (figure 16) then students are not allowed to enter the laboratory and on the LCD display: Immediately Check self to a doctor. (Figure 17).



Figure 15. Body Temperature Detection



Figure 16. Temperature $>37^{\circ}\text{C}$



Figure 17. Check with the doctor

6. CONCLUSION

From the results of the tests carried out, it can be concluded that the Arduino Uno microcontroller can control the JSN-SR04T water level sensor to measure the water level with the Led indicator on: Green Led full water, Yellow Led medium water, Red Led low water and Sensor MLX90614 to detect human temperature, where if the temperature is $< 37^{\circ}\text{C}$ the LCD display is normal temperature, but if the temperature is $> 37^{\circ}\text{C}$ the LCD display is checked by a doctor because there is a risk of contracting Covid 19.

7. THANK-YOU NOTE

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