

CS 225 – 226 Mini Project Report

Non-Contact Thermometer

Aim

The aim of this project is to create a temperature measuring device using Arduino programmable circuit with IR Temperature Sensor and displaying the temperature on Android Mobile.

About

Continuously monitoring temperature of human body. Many types of thermometers are available in market. The normal thermometer can measure temperature but its no good if the person is very sick, being in contact with him/her can spread the disease (e.g.- Situation – A person testing for Corona).

Equipment used

- Arduino Nano R3

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x). It has more or less the same functionality of the Arduino UNO, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.

- Infrared Temperature Sensor GY-906 MLX90614

The MLX90614 is an infrared thermometer for non-contact temperature measurements. Both the IR sensitive thermopile detector chip and the signal conditioning ASIC are integrated in the same TO-39 can.

Integrated into the MLX90614 are a low noise amplifier, 17-bit ADC and

powerful DSP unit thus achieving high accuracy and resolution of the thermometer.

- Android Mobile
- Female/Female Jumper Wires
Jumper wires typically come in three versions: male-to-male, male-to-female and female-to-female. The difference between each is in the endpoint of the wire. Male ends have a pin protruding and can plug into things, while female ends do not and are used to plug things into.
- OTG Adapter

Apps/Software/Online Services used

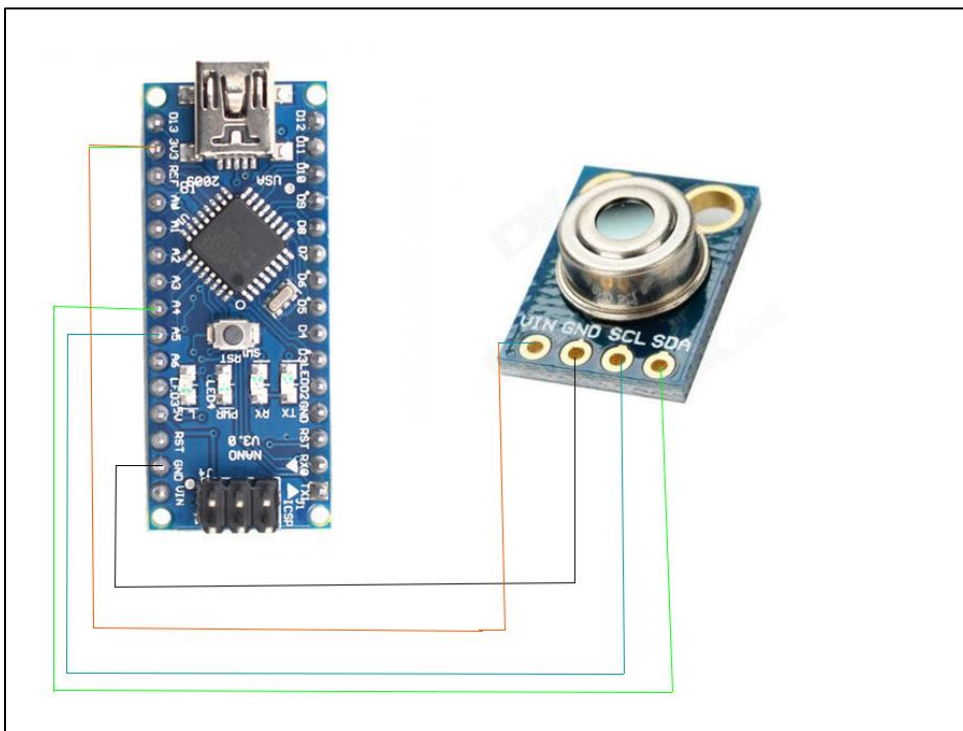
- Arduino IDE
The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board.
- Serial USB Terminal Application (On Android)

Working

- The main component used in this project is MLX90614 Non-contact IR Sensor. The output from this sensor is connected to Arduino Nano. Arduino print the temperature on smart phone with the help of Serial Monitor Android App. Arduino and Temperature Sensor takes power from Android Device. So, no need of external Power Source.

- ❖ MLX90614 IR Temperature Sensor Features:
 - ◆ Easy to integrate
 - ◆ Factory calibrated in temperature range:
 - $-40+125^{\circ}\text{C}$ for sensor temperature
 - $-70+380^{\circ}\text{C}$ for object temperature
 - ◆ High accuracy of 0.5°C over wide temperature range ($+50^{\circ}\text{C}$ for both) High (medical) accuracy calibration
 - ◆ I2C Interface to communicate with microcontroller
- Arduino Nano is used for fetching the program of Temperature Sensor inside the Arduino Nano Circuit.
- Android is used as Serial Monitor to display the temperature which MLX90614 has sensed.
- Jumper Cables are used for connection between Sensor, Arduino Nano and Smartphone.

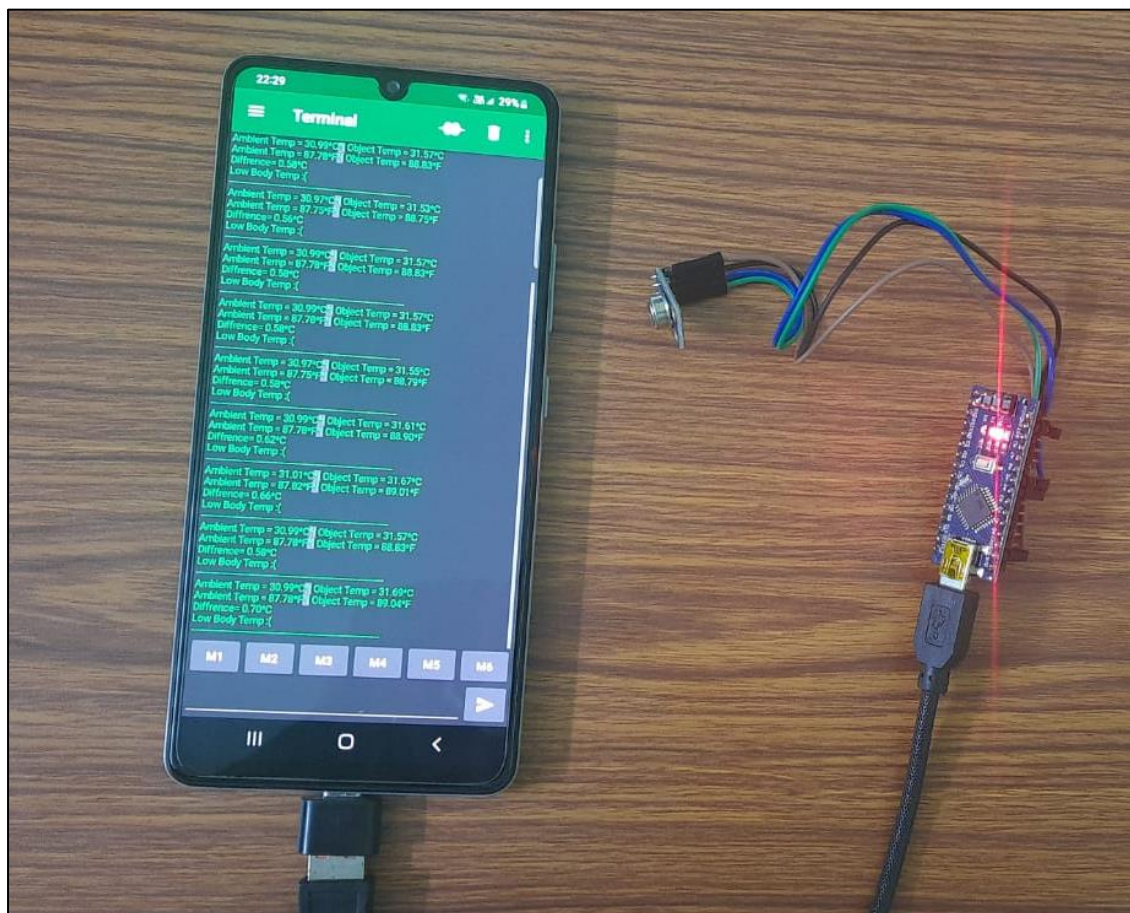
Schematic



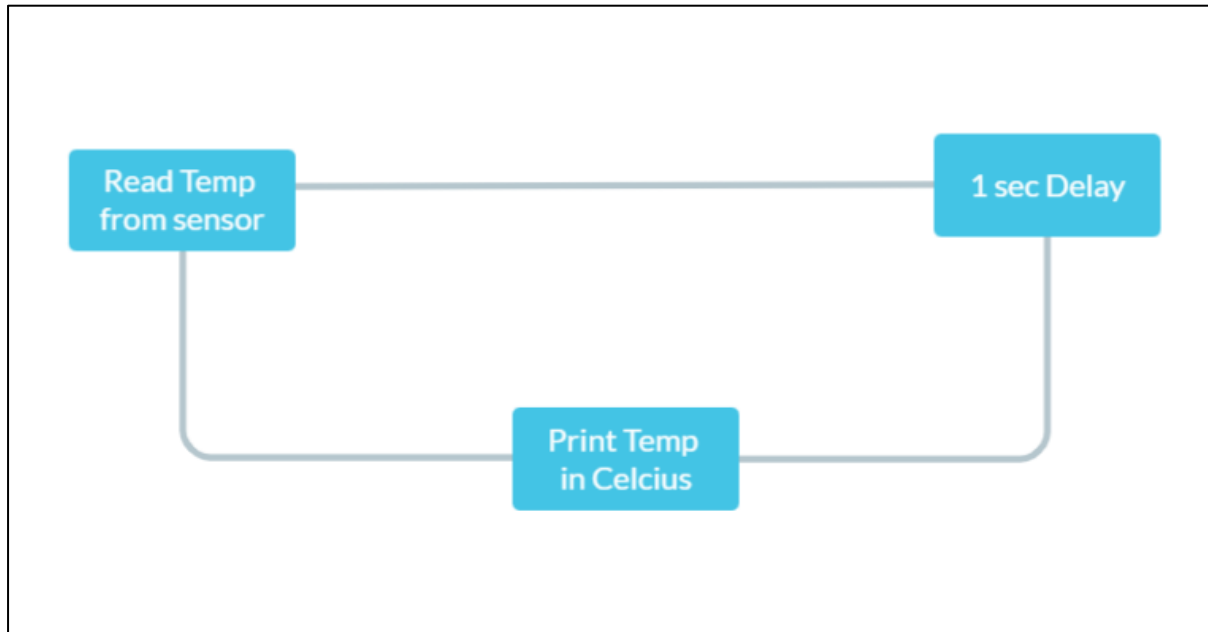
Hardware Connections

- ❖ Arduino Nano MLX90614
- ❖ A4 - SDA
- ❖ A5 - SDL
- ❖ 3.3V - VIN
- ❖ GND - GND

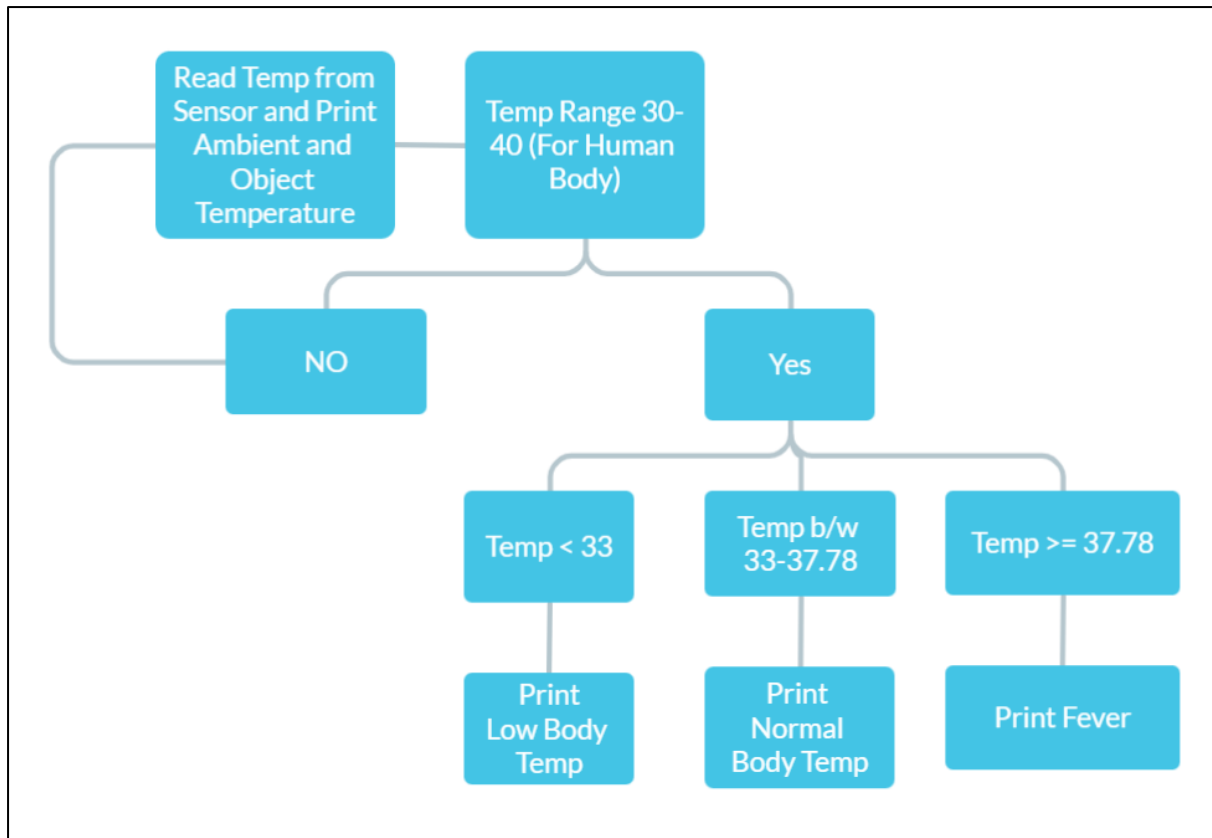
Image of Project



Flow Chart (Testing)



Flow Chart of Logic (Fever Detect)



Code Snippet and Explanation

1)Test_Sensor (To test if sensor is working)

```
Test_Sensor
//Include libraries
#include <Wire.h>
#include <Adafruit_MLX90614.h>
Adafruit_MLX90614 mlx = Adafruit_MLX90614();

//Initial Setup
void setup() {
  Serial.begin(9600);
  mlx.begin();
}

void loop() {

  Serial.print("Temperature : ");
  Serial.print(mlx.readObjectTempC()); //read temp from sensor and print it
  Serial.println(" Celsius");

  Serial.println();
  delay(1000); //1 sec delay
}
```

2)Code_Main (Actual Code for monitoring body temperature)

Code_Main\$

```
//Including Requied Libraries
#include <Wire.h>
#include <Adafruit_MLX90614.h> //Library for MLX90614 IR Temp Sensor
Adafruit_MLX90614 mlx = Adafruit_MLX90614();

void setup() {
  Serial.begin(9600); //Braud Rate
  Serial.println("Arduino Project"); //Print Arduino Project
  Serial.println("Non-Contact Thermometer"); //print Project Name
  Serial.println("Kartik Mouli"); //print Name
  mlx.begin(); //Initialise Sensor
}

void loop() {

  float a, b, c, d; //Variables Declaration to store temp

  //store ambient temp and object temp in Celcius
  a = mlx.readAmbientTempC();
  b = mlx.readObjectTempC();

  //store ambient temp and object temp in Fahrenheit
  c = mlx.readAmbientTempF();
  d = mlx.readObjectTempF();
```

```
//for Object Temp
//print temp in celcius
Serial.print("Ambient Temp = ");
Serial.print(a); //print ambient temp
Serial.print("*C\t Object Temp = ");
Serial.print(b); //print object temp
Serial.println("*C");

//print temp in fahrenheit
Serial.print("Ambient Temp = ");
Serial.print(c); //print ambient temp
Serial.print("*F\t Object Temp = ");
Serial.print(d); //print object temp
Serial.println("*F");

//difference between ambient and object temp
Serial.print("Difference= ");
Serial.print(b - a); //print diff in Celcius
Serial.println("*C");
```

```

//for Human Body, Fever Detection

if (b > 30 && b < 40) { //30-40 C normal temp of human body in fever
  if (b >= 37.78) {
    Serial.print("Fever :"); //print fever if temp is above 37.78 C
  }
  else if (b < 33) {
    Serial.print("Low Body Temp :"); //print low body temp if temp is less than 33 C
  }
  else {
    Serial.print("Normal Body Temp :"); //print normal body temp if temp is b/w 33-37.78
  }
}

Serial.println("\n-----"); //print line

delay(3000); //delay of 3 sec
}

```

Explanation

Read data from MLX90614 and Print Temperature in Celsius and Fahrenheit. Also print difference between Ambient Temp and Objects Temp in Celsius. For Fever Detection in Human Body, Human body temp ranges from 30-40 C in extreme conditions. If body temp is b/w 33-37.38 C (Normal body temp) or body temp less than 33 C or body temp greater than 37.78 C (Fever), It will print according to that Person have Normal body temp, Low body temp or Fever.

Applications

This Arduino based project can have various applications:

- High precision non-contact temperature measurements
- Thermal Comfort sensor for Mobile Air Conditioning control system
- Temperature sensing element for residential, commercial and industrial building air conditioning
- Windshield defogging
- Automotive blind angle detection
- Industrial temperature control of moving parts
- Temperature control in printers and copiers
- Home appliances with temperature control
- Healthcare
- Livestock monitoring
- Movement detection

- Multiple zone temperature control – up to 100 sensors can be read via common 2 wires
- Thermal relay/alert
- Body temperature measurement

Conclusion

This project is fairly simple to build but has a lot of useful applications. However, while working on the project I found that the sensor shows nearly accurate output when its 2-4 cm close to object.