# Innovations in Temperature Measurement: A Contactless Approach with MLX and Arduino

Garv Sharma
*dept. Computer Science with Artificial Intelligence and Robotics*
*Vellore Institute of Technology, Chennai,India*
garv.sharma.2022@vitstudent.ac.in

Anvesha Singh
*dept. Computer Science with Artificial Intelligence and Robotics*
*Vellore Institute of Technology, Chennai,India*
anvesha.singh.2022@vitstudent.ac.in

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## I. ABSTRACT

Creating a contactless thermometer using an Arduino and an MLX sensor (like the MLX90614 or MLX90632) involves reading the temperature data from the sensor and then displaying or processing that data.

## II. INTRODUCTION

In today's world, where health and safety are paramount concerns, the need for accurate and efficient temperature measurement methods has never been more critical. Traditional thermometers, while effective, often require physical contact with the subject, posing challenges in situations where hygiene and speed are essential. In response to this demand, innovative technologies have emerged, offering contactless temperature measurement solutions that are both reliable and convenient.

Among these innovations, the integration of MLX (Melexis) sensors with Arduino microcontrollers stands out as a promising approach. MLX sensors, renowned for their precision and versatility in measuring temperature, combined with the flexibility and accessibility of Arduino platforms, offer a compelling solution for various applications, including medical diagnostics, industrial monitoring, and home automation.

This research paper aims to explore the principles, design considerations, and practical implementation of a contactless thermometer system utilizing MLX sensors and Arduino. By delving into the underlying technology and methodologies, this study seeks to provide a comprehensive understanding of how such systems operate and their potential advantages over conventional temperature measurement devices.

## III. PRIMARY OBJECTIVES

*A. Understanding MLX Sensor Technology:*
Investigating the working principles and features of MLX sensors, including their ability to detect infrared radiation emitted by objects and convert it into temperature readings.

*B. Exploring Arduino Integration:*
Examining the process of interfacing MLX sensors with Arduino microcontrollers, including hardware connections, programming techniques, and data processing algorithms.

*C. Performance Evaluation:*
Conducting experiments to evaluate the accuracy, reliability, and response time of the contactless thermometer system under various conditions and comparing its performance with traditional thermometers.

*D. Applications and Implications*:
Discussing potential applications of contactless thermometer systems in healthcare, industry, and everyday life, as well as their implications for improving efficiency, safety, and hygiene standards.

## IV. COMPONENTS

TABLE 1. Components Used

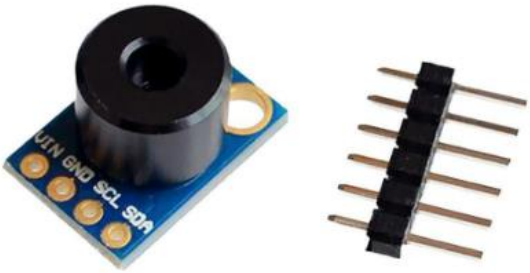
| |
|---|
| Arduino Uno |
| MLX90614 Sensor |
| 0.96 inch OLED Screen |
| BreadBoard |
| USB cable |
| Electrical Wires |
| PowerBank |

### *A. Arduino UNO*

The Arduino Uno is a versatile microcontroller board, ideal for beginners and hobbyists. Powered by the ATmega328P, it offers 14 digital I/O pins, 6 analog inputs, USB connectivity, and a user-friendly environment for programming. With a range of applications, from controlling LEDs to interacting with sensors, the Uno serves as a gateway for learning electronics and programming. Its simplicity, coupled with a vibrant community, makes it an excellent platform for experimenting and creating various projects.


### B. *MLX Sensor*

The MLX sensor, developed by Melexis, is a highly versatile and precise sensor designed for temperature measurement. Operating on the principle of infrared thermometry, MLX sensors detect the infrared radiation emitted by objects and convert it into temperature readings. These sensors are known for their exceptional accuracy, fast response times, and wide temperature measurement range.

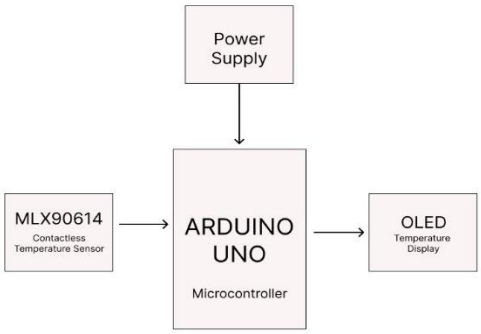



### C. *OLED Screen*

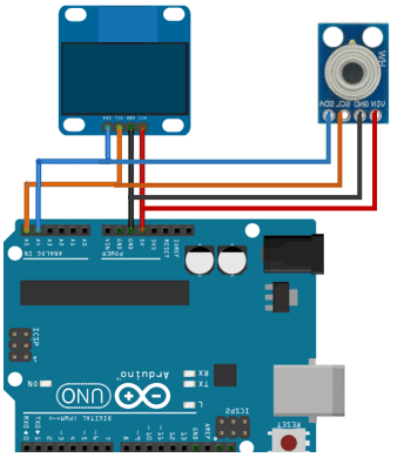
A 0.96-inch OLED (Organic Light-Emitting Diode) screen is a compact display module known for its vibrant colors, high contrast ratio, and excellent visibility even in bright light conditions. OLED technology consists of organic compounds that emit light when an electric current is applied, eliminating the need for a backlight and resulting in deeper blacks and more energy-efficient displays compared to traditional LCD screens. This will be used to display the temperature in real time.

## V. METHODOLOGY

### A. *Block Diagram*




### B. *Circuit Diagram*



### C. *Algorithm*

- Connect the MLX sensor to the Arduino.
- Make sure to provide the necessary power and ground connections.
- Connect the SDA and SCL pins of the sensor to the corresponding pins on the Arduino (A4 for SDA, A5 for SCL on most Arduino boards).
- Include Libraries: Include the necessary libraries for I2C communication and the MLX sensor.
- Initialize Sensor: Initialize the MLX sensor in the setup function.
- Read Temperatures: Use the readObjectTempC() and readAmbientTempC() functions to get the object and ambient temperatures in Celsius, respectively.
- Print Data: Print the temperature values to the Serial Monitor for testing and debugging. Adjust the format as needed.
- Delay: Introduce a delay between temperature readings to avoid overwhelming the Serial Monitor and to allow time for the sensor to stabilize.

## VI. WORKING

*A. MLX Sensor Measurement:*

The contactless thermometer integrates an MLX sensor, such as the MLX90614, situated to capture temperature readings without physical contact. The sensor operates on infrared radiation detection principles, accurately measuring object and ambient temperatures from a distance.

*B. Data Transmission to Display:*

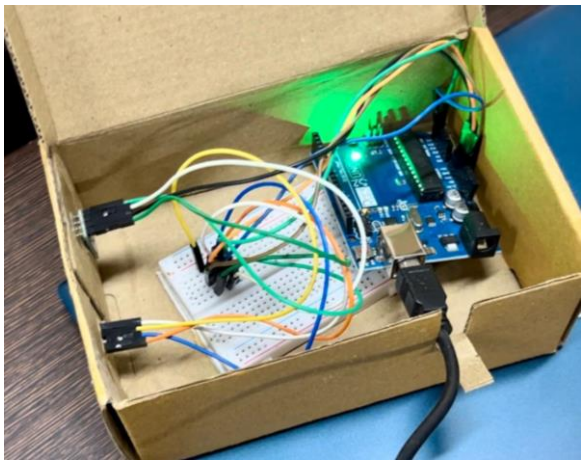
Temperature data captured by the MLX sensor is processed by an Arduino Uno microcontroller, serving as the core of the system. Utilizing libraries for the MLX sensor and I2C communication protocol, the Arduino retrieves temperature readings.

*C. Display Interface:*

An OLED display interface presents temperature readings in a clear and intuitive manner. The Arduino communicates with the display to showcase real-time temperature information, ensuring user-friendly interaction compartment.

*D. User Interaction:*

Users can access temperature readings without physical contact, promoting safety and hygiene. The contactless nature of the thermometer allows for effortless integration into various environments, such as building entrances, ensuring seamless temperature monitoring.



## VII. RESEARCH CHALLENGES

• Achieving accurate temperature readings through sensor calibration and noise reduction with MLX90614.
• Efficient integration of sensor data with Arduino Uno while managing memory constraints and processing capabilities.
• Designing an intuitive user interface on the limited space of the OLED display for clear temperature presentation.
• Optimizing power consumption for extended battery life without sacrificing performance.
• Conducting thorough testing to ensure accuracy, reliability, and usability in diverse conditions.

## VIII. CONCLUSION / FUTURE WORKS

This research explored building a contactless thermometer using an Arduino and an MLX sensor for safe body temperature measurement. Challenges identified included achieving accurate readings, integrating data with the Arduino's limitations, and designing a clear user interface. The methodology outlined the steps for building the thermometer, including sensor connection, code development, and temperature display.

Future work suggests implementing calibration techniques, data filtering, a more user-friendly interface, and power optimization. Rigorous testing is also crucial for ensuring accuracy and compliance with safety standards. This project lays the groundwork for a reliable and user-friendly contactless thermometer with further development.

## IX. REFERENCES


[1]https://www.sciencedirect.com/science/article/pii/S2468067221000122

[2]https://ieeexplore.ieee.org/document/9299586/citationscitations

[3] https://www.nature.com/articles/s41598-021-99300-1

[4]https://www.mdpi.com/1424-8220/23/17/7439

[5] https://pubmed.ncbi.nlm.nih.gov/33111663/

[6]https://www.sciencedirect.com/science/article/pii/S2468067221000122

[7] https://www.ijert.org/research/contactless-temperature-sensorIJERTCONV10IS11097.pdf

[8] https://www.electronicsforu.com/electronics-projects/turn-your-phoneinto-contactless-thermometer

[9] https://how2electronics.com/infrared-thermometer-using-mlx90614-arduino-oled/

[10]https://www.instructables.com/DIY-a-5-Minutes-Contactless-OLEDThermometer-With-/

[11] https://robu.in/how-to-design-thermometer-using-arduino/


## X. RELATED WORKS


[1] https://www.hackster.io/LithiumION/non-contact-infrared-temperature-sensor-using-arduino-303ca4

[2] https://www.instructables.com/MLX90614-Non-Contact-Infrared-Temperature-Sensor-W/

[3] https://hackaday.io/project/184902-non-contact-infrared-temperature-sensor-arduino

[4] https://circuitdigest.com/microcontroller-projects/ir-thermometer-using-arduino-and-ir-temperature-sensor

[5] https://www.electronics-lab.com/project/infrared-thermometer-arduino-mlx90614-temperature-sensor/

[6] https://www.mdpi.com/1424-8220/21/11/3817

[7]https://www.sciencedirect.com/science/article/pii/S2468067221000122

[8]https://www.pcbway.com/blog/Activities/Contactless_Thermometer_using_Arduino_with_SD_card_temperature_logger.html