KIT-KALAIGNARKARUNANIDHI INSTITUTE OF TECHNOLOGY

(An Autonomous Institute, Affiliated to Anna University, Chennai)

COIMBATORE – 641 402

DEPARTMENT OF BIOMEDICAL ENGINEERING

B23BMT503 - IoT in HEALTHCARE

COURSE PROJECT WORK

DESIGN OF IoT-BASED THERMOMETER

ANNA UNIVERSITY: CHENNAI 600 025

NOVEMBER 2025

Course Project Work 2025–2026

B23BMT503 – IoT in Healthcare

DESIGN OF IoT-BASED THERMOMETER

BATCH 1

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November 2025

ABSTRACT

The development of smart healthcare devices has become essential to improve efficiency, safety, and accessibility in medical monitoring systems. This project focuses on designing and implementing an **IoT-based contactless thermometer** that can measure human body temperature accurately and display it in real time without any physical contact. The system integrates a **non-contact infrared sensor**, **Wi-Fi-enabled microcontroller**, **OLED display**, and **cloud connectivity** to provide automated and intelligent temperature monitoring. The measured data is displayed locally on the OLED screen and simultaneously transmitted to the **IoT cloud** for remote access using the **Blynk mobile application**. The system also features an **alert mechanism** that notifies users when the temperature exceeds a preset threshold, ensuring timely response and improved safety. The proposed model is **portable, low-cost, and user-friendly**, making it highly suitable for use in hospitals, workplaces, and public areas where continuous health monitoring is essential.

KEYWORDS

IoT, Contactless Thermometer, Temperature Monitoring, ESP8266, Infrared Sensor, OLED Display, Blynk Application, Smart Healthcare

TABLE OF CONTENTS

LIST OF FIGURES

OBJECTIVES

The main objective of this project is to design and develop an **IoT-based contactless thermometer** that can measure human body temperature accurately, safely, and efficiently without any physical contact. The project focuses on integrating modern **IoT technology** with **smart sensors** and **wireless communication** to create a reliable, automated temperature monitoring system suitable for healthcare and public applications.

The project also focuses on enhancing **automation and connectivity** in health monitoring. The system automatically senses body temperature, processes the data through a **Wi-Fi-enabled microcontroller**, and displays the results on an **OLED screen** while simultaneously sending the data to an **IoT cloud platform**. This enables users to view temperature data remotely using the **Blynk mobile application** or other IoT dashboards. Such automation reduces manual effort, minimizes human error, and ensures faster response in identifying abnormal temperature levels.

Another major objective of this project is to provide **alert functionality** through a buzzer system. When the measured temperature exceeds a predefined threshold, the system immediately triggers an alarm to warn the user. This ensures safety and supports quick medical attention when necessary. Additionally, the system is designed to be **portable and energy-efficient**, powered by a **rechargeable Li-ion battery** with an integrated charging module, making it suitable for field and on-the-go use.

Cost-effectiveness and reliability are also key objectives of this work. By utilizing affordable components and open-source IoT platforms, the system ensures **low production cost** while maintaining high accuracy and durability. The device can be easily maintained, recharged, and reused, providing a sustainable solution for long-term applications.

Finally, the project aims to demonstrate how **IoT integration** can revolutionize healthcare monitoring by providing **real-time visibility**, **smart automation**, and **remote accessibility**. The ultimate goal is to design a **compact, low-cost, contactless thermometer** that ensures accuracy, safety, and efficiency, representing a step toward smarter healthcare systems and digital transformation in medical technology.

I. INTRODUCTION

Intravenous (IV) is a one of the big deal in the patient care service because it delivers fluids, medicines, and nutrients straight into the bloodstream in a controlled and smooth way. Even though it's a hard routine, it still needs careful monitoring system to avoid issues such as giving too much or too little fluid, or air getting into the veins can lead to serious conditions. Normally, the nurses have to watch IVs manually each time, which can lead to mistakes, human error, delays, and extra stress, especially in busy hospitals or places with limited staff.

Here with IoT and automation, monitoring has become smarter and more accurate, but still there are a lot of existing solutions, most of which are still expensive or complicated. That's why this project is based on all about a low-cost, IoT-based IV drip and flow monitoring system using the ESP32 microcontroller. It tracks the IV bag's weight with a load cell, monitors the drip flow with an IR sensor, and shows everything in real time through an OLED display. The ESP32 has been programmed automatically to send the alerts and even lets the nurses to check the info remotely through the Blynk app. By this method the patient is taken care and takes some of the load off the busy hospital staff.

A. Significance and Motivation

The main idea here is simple, accurate, continuous, and affordable IV monitoring. Relying on manual checks can cause human errors or slow reactions, which is risky for patients and adds costs. Automation of this process makes everything really fast, precise, and saves the time of the nurses and patients, which will be more useful in the medical field.

This project uses simple sensors and IoT connectivity, this system brings a smart healthcare system to hospitals, emergency units, and even home healthcare systems. It is compact, battery-powered, and easy to set up anywhere. Basically, it proves that smart, connected healthcare doesn't have to be expensive it can be low-cost by our method, scalable tech can really improve patient safety and make hospitals to work smoother.

II. LITERATURE REVIEW

The **Literature Survey** provides an overview of previous research and developments related to **IoT-based temperature monitoring systems**. Several researchers have contributed to this field by designing models that integrate sensors, microcontrollers, and cloud platforms for health monitoring. However, most of these systems face challenges such as limited portability, lack of real-time alerts, and restricted data accessibility. The present study aims to overcome these limitations by proposing a more efficient and compact IoT-enabled temperature monitoring device.

L. M. Pires et al. (2025) developed a **low-power IoT-based temperature monitoring system** that enabled continuous temperature tracking. Their design focused on energy efficiency and stability but lacked a real-time alert system and portability. Similarly, M. H. Rahman et al. (2025) proposed an **IoT Thermologger** for real-time temperature data logging. Although the system successfully transmitted data to the cloud, it was not compact and required external power sources, reducing its practicality in mobile healthcare applications.

In 2024, S. P. Ramalingam et al. designed a **wireless body temperature monitoring system** using microcontrollers. Their model demonstrated efficient wireless data transmission, but it offered limited cloud connectivity and could not send alerts automatically. Meanwhile, M. Molsom and R. Biswas (2023) presented a **contactless automatic temperature detector** using infrared technology, focusing on accuracy and safety. However, their system was fixed in position and lacked mobility, making it unsuitable for portable healthcare monitoring. A. K. Mondal et al. (2021) implemented an **IoT-based temperature monitoring system** using a microcontroller and Blynk platform. The project provided remote data display through the cloud but lacked alert functionality and data storage features.

From the analysis of these works, it is observed that earlier models achieved **accurate sensing** and **wireless communication**, but they often failed to combine all essential features such as **portability**, **cloud storage**, **automatic alerts**, and **low-cost operation** in a single device. This study aims to overcome these research gaps by designing an **IoT-based contactless thermometer** that integrates all these features efficiently. The proposed system focuses on **real-time temperature measurement**, **instant buzzer alerts**, **data storage**, and **remote access** using IoT technology. It ensures high accuracy, low power consumption, and user-friendly operation, making it ideal for continuous temperature monitoring in healthcare and public environments.

In summary, the literature review highlights the need for an advanced, portable, and connected temperature-monitoring **device**. By combining the advantages of earlier systems while addressing their limitations, the proposed IoT-based model represents a significant improvement in smart healthcare technology, offering automation, accuracy, and accessibility in a single solution.

Reference	Contribution	Key Findings	Research Gaps	Relevance to Current Work
L. M. Pires et al. (2025)	Developed a low-power IoT system for continuous temperature monitoring	Accurate and stable readings	No alert mechanism or portability	Supports IoT-based remote temperature monitoring
M. H. Rahman et al. (2025)	Designed an IoT Thermology for real-time data tracking	Enables real-time temperature logging and analysis	Lacks portability and cloud alert	Provides a base for real-time cloud monitoring
S. P. Ramalingam et al. (2024)	Built a body temperature device using a Wi-Fi microcontroller	Wireless temperature display and monitoring	Limited cloud integration	Useful for IoT-based handheld thermometer design
M. Molsom & R. Biswas (2023)	Created a contactless auto temperature detector for COVID-19	Accurate contactless measurement	Fixed installations, no mobility	Inspires IoT integration with alert systems
A. K. Mondal et al. (2021)	Implemented IoT monitoring with ESP8266 and Blynk	Cloud-based temperature visualization	No buzzer alert or data storage	Guides IoT-cloud connection with alert features

Table 1: Comparative Study of Existing IoT-Based Temperature Monitoring Systems: Representative Works and Limitations

2.1 Introduction

The literature survey presents a detailed review of existing research and technological advancements related to **IoT-based temperature monitoring systems**. The main goal of this section is to analyse previously developed models, identify their strengths, and highlight the research gaps that form the foundation for the proposed system. Many researchers have worked on integrating sensors, microcontrollers, and wireless communication technologies to design smart health monitoring devices. However, most of these systems still face limitations such as a **lack of automation**, **restricted portability**, the **absence of alert systems**, and **limited cloud connectivity**.
The current project aims to overcome these limitations by developing a **portable IoT-based contactless thermometer** capable of measuring temperature accurately, displaying data in real time, and transmitting information to a cloud server for continuous monitoring. This review summarises the major works done in this field and how the proposed system enhances the overall efficiency and usability compared to existing models.

2.2 Review of Previous Research Works

Several research works have contributed to the development of IoT-enabled health monitoring systems. Some of the most relevant studies are discussed below:

- **L. M. Pires et al. (2025)** developed a **low-power IoT system** for continuous temperature monitoring. Their system achieved **stable and accurate readings**, but it lacked **portability and an alert mechanism** for detecting abnormal temperatures.
- **M. H. Rahman et al. (2025)** designed an **IoT Thermologger** for real-time data tracking. Although the system successfully logged temperature data to a cloud server, it was **not portable** and **lacked automated alerts**, reducing its suitability for on-the-go monitoring.
- **S. P. Ramalingam et al. (2024)** proposed a **Wi-Fi-based body temperature device** that displayed readings wirelessly. This system achieved reliable communication but provided only **limited cloud connectivity** and lacked **buzzer alerts** for high-temperature detection.
- **M. Molsom and R. Biswas (2023)** introduced a **contactless temperature detection system** using infrared sensors. It offered **accurate and hygienic temperature measurement**, yet it was designed for **fixed installation** and not suitable for portable use.
- **A. K. Mondal et al. (2021)** implemented an **IoT temperature monitoring system** using ESP8266 and Blynk platforms. The project supported **cloud-based visualisation** but did not include a **buzzer**

alert or **data storage feature**, limiting its effectiveness for healthcare applications.

2.3 Summary of Literature Survey

From the above studies, it is clear that **IoT-based temperature monitoring** has gained significant attention due to its potential in healthcare applications. Each research contributed valuable insights into improving accuracy, wireless communication, and cloud integration. However, most of the existing systems suffer from a few common limitations, such as:

- Dependence on **contact-based sensors**, which are less hygienic and slower.
- **Lack of automated alerts** for detecting high temperatures.
- **No real-time cloud synchronisation** for continuous data monitoring.
- **Limited portability** and **high production costs** in existing designs.

To overcome these challenges, the **proposed IoT-based contactless thermometer** introduces an advanced system that is **portable, automated, and cloud-connected**. It integrates all essential features such as **contactless sensing, real-time display, cloud access, and alert functionality** into one compact device.

This combination ensures accurate, safe, and continuous temperature monitoring, making the proposed design highly effective for hospitals, schools, workplaces, and public areas. Therefore, this project serves as a **technological improvement over existing models**, contributing to the advancement of **smart healthcare systems** using IoT technology

III. METHODOLOGY

3.1 Introduction

This chapter describes the overall **methodology** adopted for the design and development of the **IoT-Based Contactless Thermometer**. The methodology involves a sequence of steps beginning from understanding the existing models, identifying their drawbacks, and proposing an improved system capable of **automatic, real-time, and contactless temperature measurement**. The system uses a **Wi-Fi-enabled microcontroller**, **infrared sensor**, and **IoT platform** to perform accurate measurements and remote data monitoring. Each stage of development — from problem identification to testing — is clearly explained through sub-sections in this chapter.

3.2 Existing Model

In the existing systems, temperature measurement is usually carried out using **contact-based thermometers** such as mercury or digital thermometers.
Although these devices are accurate, they are **time-consuming**, require **physical contact**, and cannot be used for continuous or remote monitoring.

Some researchers have introduced **IoT-based thermometers**, but they still rely on **wired sensors**, **manual data collection**, and a **lack of alert mechanisms**. These models are not portable and often need an external power supply, limiting their usability in real-time healthcare monitoring.

Limitations of Existing Model

- Requires **direct contact** with the human body.
- **No automatic alerts** for high temperature detection.
- **No real-time or remote monitoring** capability.
- **Data not stored or analysed** for future reference.
- Systems are often **bulky, expensive, and not portable**.

These limitations provided the foundation and **motivation** for developing an improved, IoT-enabled, contactless thermometer.

3.3 Motivation Behind This Project

The motivation for this project arose from the growing need for **efficient, safe, and smart temperature monitoring systems** in healthcare and public sectors. Traditional thermometers require human involvement and direct touch, which is inconvenient and unsuitable for frequent use in public environments.

We were motivated to design a device that could measure temperature **instantly and accurately without contact**. The idea of integrating **IoT (Internet of Things)** technology offered the possibility of **remote access, cloud data storage, and real-time alerts**, which could make the system smarter and more reliable.

The main motivation points are:

- To create a **contactless and hygienic** temperature monitoring method.
- To design a **portable and low-cost** solution for continuous health monitoring.
- To utilise **IoT connectivity** for **real-time data visualisation** and **remote alerts**.
- To combine **automation and smart sensing** in a single, user-friendly system.
- To enhance **accuracy, safety, and convenience** in medical temperature measurement.

3.4 Proposed Model

The proposed system is an **IoT-based contactless thermometer** that measures temperature automatically using an **infrared sensor** and transmits the data to an **IoT cloud platform** for real-time monitoring. The device is designed to be **compact, battery-powered, and portable**, making it suitable for hospitals, offices, and public areas.

The system consists of the following key components:

- **ESP8266 Microcontroller:** Acts as the main control unit and handles data processing and Wi-Fi communication.

- **MLX90614 Infrared Sensor:** Detects body temperature without physical contact.
- **OLED Display:** Displays live temperature readings for instant local observation.
- **Buzzer:** Provides an alert when the temperature exceeds the preset threshold.
- **Li-ion Battery with TP4056 Charging Module:** Powers the system and ensures portability.
- **IoT Cloud (Blynk/ThingSpeak):** Enables remote data access through a smartphone or web dashboard.

3.5 Working Principle

The **MLX90614 sensor** detects the infrared radiation emitted from the human body and converts it into a digital temperature value. This data is transferred to the **ESP8266 microcontroller** via the **I²C communication protocol**.
The ESP8266 processes the data and displays it on the **OLED screen**. Simultaneously, it uploads the temperature reading to the **Blynk IoT cloud** through Wi-Fi. If the temperature exceeds a predefined limit (for example, 38°C), the **buzzer** is automatically activated to indicate fever. Thus, the system provides **local display, remote monitoring, and alert generation** simultaneously.

3.6 Block Diagram Explanation

The block diagram of the proposed system includes the following modules:

1. Power Subsystem (Li-Ion Battery + TP4056 Charger):

- Provides a stable **3.3V supply** to the entire circuit.

- The **TP4056 charging module** ensures safe charging of the Li-ion battery via a **Type-C port**, making the system portable and rechargeable.

2.ESP8266 Microcontroller (NodeMCU):

- Acts as the **main control unit** of the system.
- The ESP8266 also has built-in **Wi-Fi capability**, enabling the data to be sent to a **cloud platform** or **mobile app** in real-time.
- It reads temperature data from the sensor using the **I2C communication** protocol.

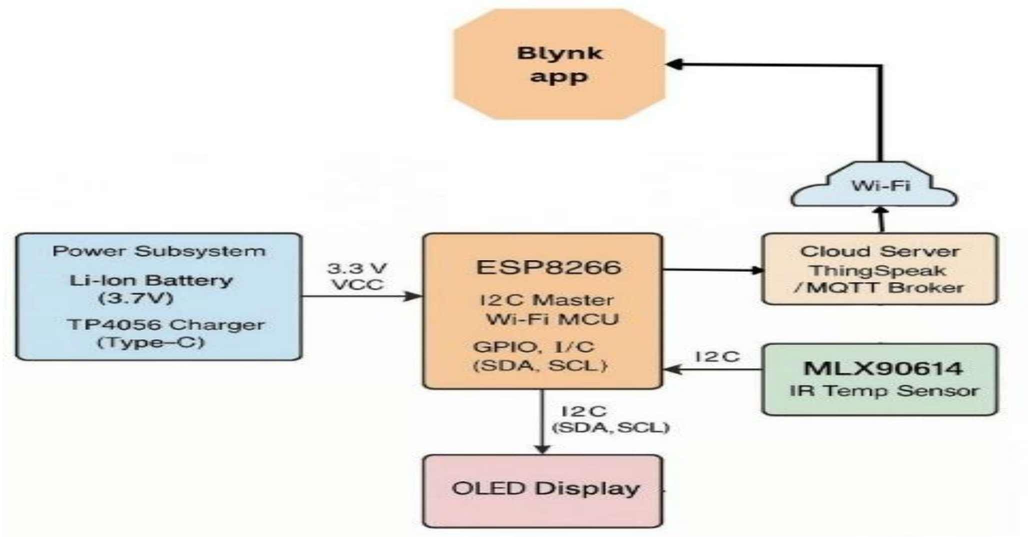

FIGURE 1:BLOCK DIAGRAM OF THE PROPOSED SYSTEM MODEL

3. MLX90614 IR Temperature Sensor:

- A **contactless infrared sensor** that measures the body temperature of the person or object.
- It transmits the measured value to the ESP8266 through the I2C interface for processing and display.

4. OLED Display:

- Displays the **instant temperature readings** measured by the sensor.
- Provides a clear visual output for easy monitoring.

5. Cloud Server (Blynk):

- Receives the data from the ESP8266 via Wi-Fi and stores it for **remote access and data logging**.
- Enables continuous monitoring and analysis of temperature data.

6. Blynk App:

- Acts as the **user interface** on a smartphone.
- Displays real-time temperature readings and alerts the user when the temperature crosses a set threshold.

3.7 Flow of the System

The operation of the system follows the flow below:

1. Power ON the system.
2. Initialise microcontroller, Wi-Fi, and sensor modules.
3. Read temperature data from the MLX90614 sensor.
4. Display the reading on the OLED display.
5. If the temperature exceeds the threshold → activate the buzzer.
6. Send temperature data to the Blynk IoT cloud.
7. Repeat the process continuously.

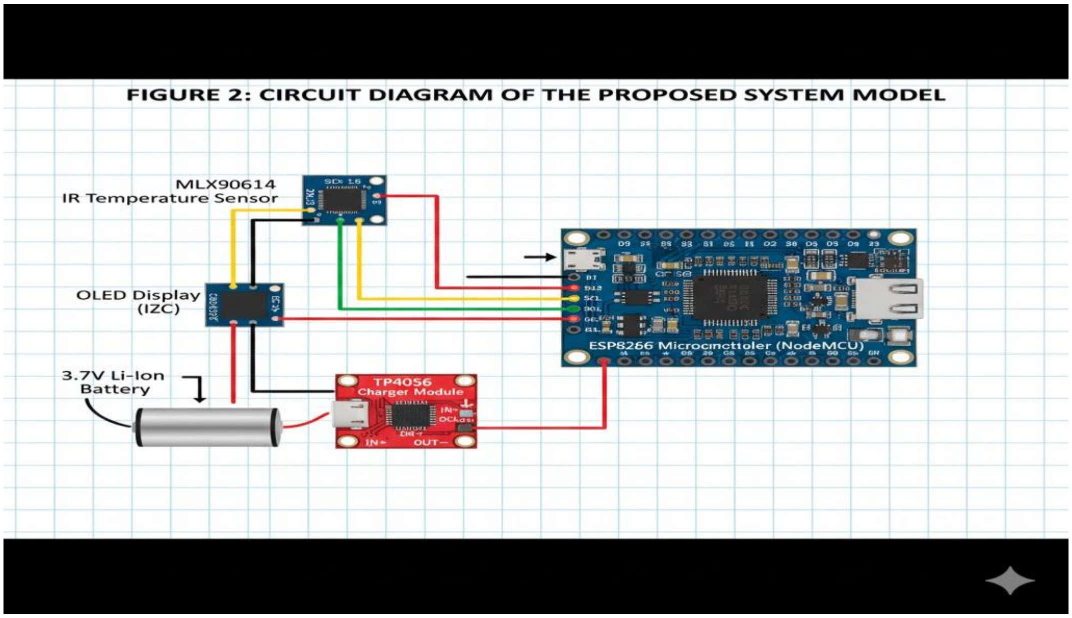

FIGURE 2: CIRCUIT DIAGRAM OF THE PROPOSED SYSTEM MODEL

3.8 Pseudocode of the Proposed System

Step 1: Initialise serial communication, sensor, display, Wi-Fi, and Blynk connection.

Step 2: Read the temperature value from the MLX90614 sensor.

Step 3: Display temperature on OLED.

Step 4: If temperature > 38°C, turn ON buzzer; else turn OFF.

Step 5: Send temperature and alert status to the Blynk cloud.

Step 6: Repeat continuously.

```
#define BLYNK_TEMPLATE_ID "TMPL35ysfqiw6"
#define BLYNK_TEMPLATE_NAME "sansusa"
#define BLYNK_AUTH_TOKEN "1pn4lsWbacLznWTGXs4y_JbFF9TRZj9"

#include <Wire.h>
#include <Adafruit_MLX90614.h>
#include <Adafruit_GFX.h>
#include <Adafruit_SSD1306.h>
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

char ssid[] = "Sanjai@0077";
char pass[] = "7777777777";

#define SCREEN_WIDTH 128
#define SCREEN_HEIGHT 64
Adafruit_SSD1306 display(SCREEN_WIDTH, SCREEN_HEIGHT, &Wire, -1);

Adafruit_MLX90614 mlx = Adafruit_MLX90614();

BlynkTimer timer;  // instead of delay

#define BUZZER_PIN D5  // Change if needed

void sendSensor() {
  float objectC = mlx.readObjectTempC();

  // Validate temperature reading
  if (isnan(objectC) || objectC < 20.0 || objectC > 50.0) {
    // Retry once
    delay(50);
    objectC = mlx.readObjectTempC();
    if (isnan(objectC) || objectC < 20.0 || objectC > 50.0) {
      Serial.println("Invalid sensor reading, skipping update");
      return; // skip sending
    }
  }

  // Send temperature to Blynk V10
  Blynk.virtualWrite(V10, objectC);

  // Serial output
  Serial.print("Object Temperature: ");
  Serial.print(objectC);
  Serial.println(" °C");

  // OLED display
  display.clearDisplay();
  display.setTextSize(1);
  display.setCursor(0, 0);
  display.println("Temperature Monitor");

  display.setTextSize(2);
  display.setCursor(0, 25);
  display.print("Obj: ");
  display.print(objectC, 1);
  display.println("C");

  display.display();

  // Buzzer logic
  int buzzerState = LOW;
  if (objectC >= 38.0) {
    digitalWrite(BUZZER_PIN, HIGH);  // Buzzer ON
    buzzerState = HIGH;
  } else {
    digitalWrite(BUZZER_PIN, LOW);   // Buzzer OFF
  }

  // Send buzzer state to Blynk V11
  Blynk.virtualWrite(V11, buzzerState); // 1 = ON, 0 = OFF
}

void setup() {
  Serial.begin(9600);
  Wire.begin(D2, D1);  // SDA, SCL

  pinMode(BUZZER_PIN, OUTPUT);
  digitalWrite(BUZZER_PIN, LOW); // Ensure buzzer OFF initially

  // Connect Blynk
  Blynk.begin(BLYNK_AUTH_TOKEN, ssid, pass);

  // Initialize MLX90614
  if (!mlx.begin()) {
    Serial.println("Error: MLX90614 not found!");
    while (1);
  }
  delay(500); // stabilize sensor
  Serial.println("MLX90614 ready...");

  // Initialize OLED
  if (!display.begin(SSD1306_SWITCHCAPVCC, 0x3C)) {
    Serial.println("SSD1306 allocation failed");
    while (1);
  }
  display.clearDisplay();
  display.setTextColor(SSD1306_WHITE);
  display.setTextSize(1);
  display.setCursor(0, 0);
  display.println("MLX90614 + Blynk");
  display.display();
  delay(2000);

  // Call sendSensor() every 2 seconds
  timer.setInterval(2000L, sendSensor);
}

void loop() {
  Blynk.run();
  timer.run(); // smooth updates
}
```

FIGURE 3: ARDUINO CODE FOR THE PROJECT

3.9 Advantages of the Proposed System

- Provides **contactless and hygienic** temperature measurement.
- Ensures **real-time monitoring** and **instant alert notifications**.
- **Portable, battery-powered, and low-cost** design.
- **Cloud-based data storage** for remote viewing.
- Reduces manual effort and increases **accuracy and reliability**.

3.10 Methodology Flowchart

The project methodology follows these steps:

1. **Problem Identification and Requirement Study.**
2. **Component Selection and System Design.**
3. **Coding and Hardware Integration.**
4. **Testing and Calibration.**
5. **Data Transmission and Cloud Setup.**
6. **Performance Evaluation and Validation**

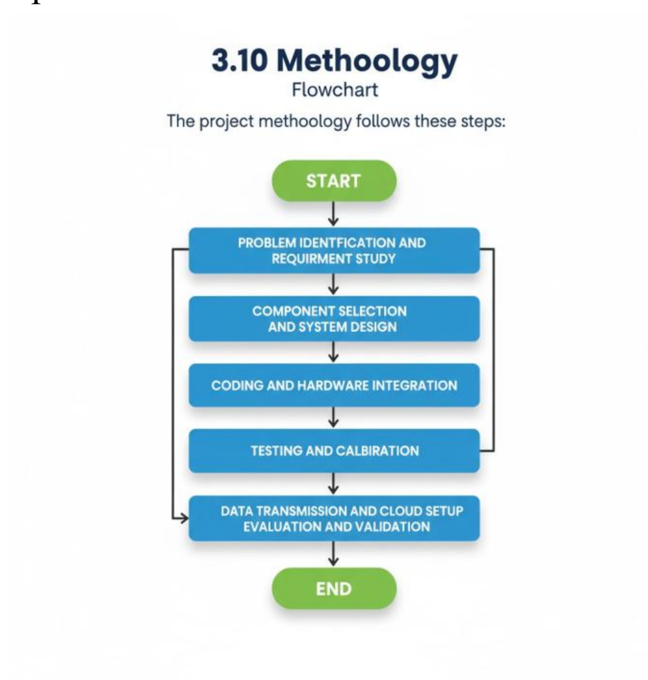

FIGURE 3: FLOW CHART FOR METHODOLOGY

3.11 Summary

The methodology involves the complete process of system design, implementation, and testing of the **IoT-based contactless thermometer**. The proposed model overcomes the limitations of the existing systems by combining **infrared sensing**, **IoT-based cloud monitoring**, and **real-time alerting**. The methodology ensures that the system is **accurate, portable, and reliable**, making it suitable for both clinical and public use.

This design approach demonstrates how **IoT technology** can enhance healthcare monitoring by providing **automation, connectivity, and convenience** in a compact and efficient system.

ESP8266 MICROCONTROLLER AND **MLX90614** SENSOR (**Heart and Brain of the Project**)

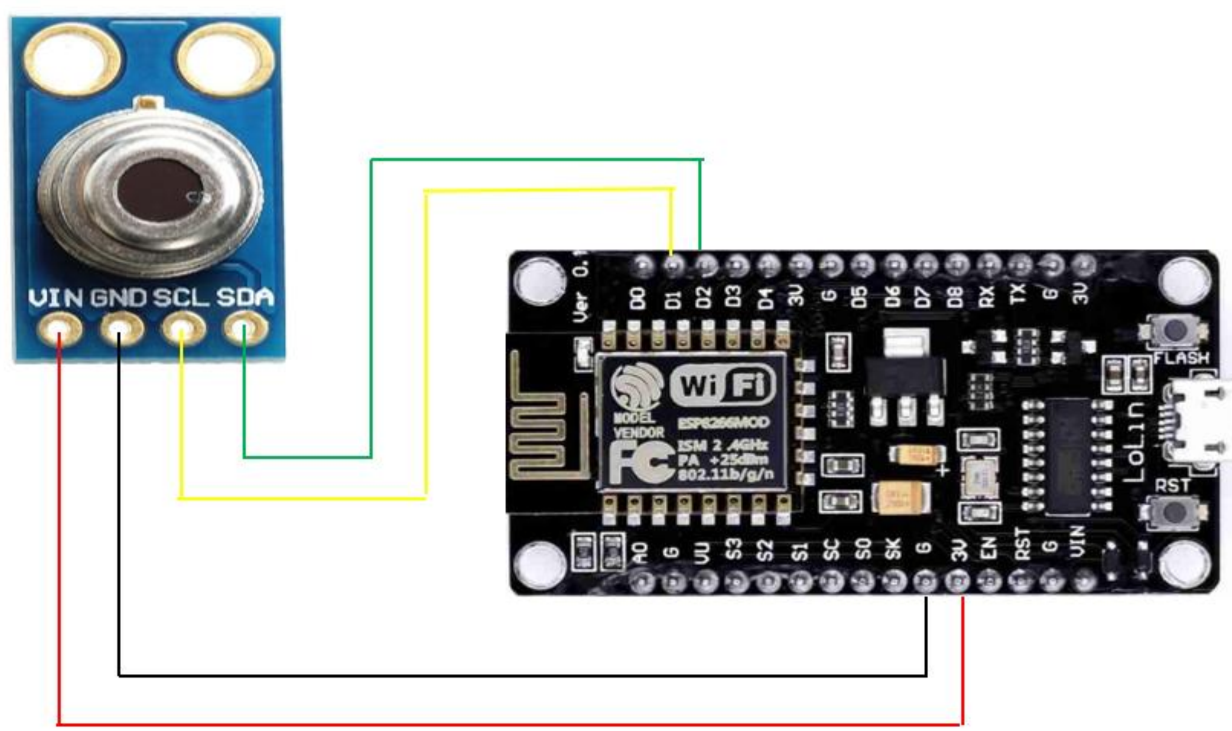

FIGURE 4: CONNECTION BETWEEN MLX90614 SENSOR AND ESP8266 MICROCONTROLLER

The connection shown above represents the **core functional block** of the proposed IoT-Based contactless Thermometer. Here, the **MLX90614 Infrared Temperature Sensor** acts as the **heart** of the system — sensing and converting thermal radiation into accurate temperature readings. The **ESP8266 NodeMCU** functions as the **brain**, processing this data and transmitting it to the cloud for real-time monitoring.

MLX90614 Infrared Sensor

The MLX90614 is a high-precision, non-contact infrared (IR) temperature sensor used to measure the temperature of an object or human body without physical contact. It detects infrared energy emitted by a surface and converts it into a digital signal that corresponds to temperature. It is ideal for **hygienic applications**, **body temperature monitoring**, and **medical thermometers**, providing high accuracy (±0.2°C) and fast response time.

Key Features:

- Non-contact temperature measurement
- High accuracy and low noise output
- Supports I^2C digital communication
- Operates at 3.3V to 5V DC
- Wide measurement range: -70°C to +380°C

ESP8266 NodeMCU Microcontroller

The ESP8266 NodeMCU is a **Wi-Fi-enabled microcontroller** that serves as the control and communication unit of the system. It collects sensor data, processes it, and sends it to the IoT cloud platform (such as Blynk or ThingSpeak) through Wi-Fi connectivity. It also controls the **OLED display** and **buzzer alerts**, acting as the brain that coordinates all functions.

Key Features:

- Built-in Wi-Fi module for IoT connectivity
- Supports I²C and GPIO communication
- Operates at 3.3V, ideal for low-power applications
- Compact and cost-effective design

Interfacing Between MLX90614 and ESP8266

The MLX90614 communicates with the ESP8266 via the I²C protocol, which uses two lines:

- SDA (Serial Data) for data transmission
- SCL (Serial Clock) for synchronisation

MLX90614 Pin	ESP8266 Pin	Function
VIN	3.3V	Power Supply
GND	GND	Ground Connection
SDA	D2 (GPIO 4)	Data Line
SCL	D1 (GPIO 5)	Clock Line

This setup ensures smooth and efficient communication between the sensor and the microcontroller.

Annunciator: OLED Display gives a clear visual feedback of the fluid volume, drip rate, and the infusion time while triggering audible buzzer and visual LED alerts in case of abnormalities.

FIGURE 5. OLED DISPLAY

Pin connections:

OLED Display Pin	ESP32 Pin (GPIO)
GND	GND
VCC	**3.3V** or **5V**
SCL	GPIO 22
SDA	GPIO 21

Working Process

1. The MLX90614 measures infrared radiation from the human body and converts it into a temperature value.
2. The measured data is sent to the ESP8266 through the I²C bus.
3. The ESP8266 processes the data and displays the temperature on the OLED screen.
4. The data is then uploaded to the **IoT cloud (Blynk)** for remote monitoring.
5. If the temperature exceeds the threshold, the ESP8266 triggers a buzzer alert.

Advantages of this Combination

- Provides **fast, accurate, and contactless** temperature measurement.
- Enables **IoT-based monitoring and real-time data visualisation**.
- Reduces manual effort and promotes **automation** in healthcare.
- Compact, **portable**, and **energy-efficient** setup suitable for real-world use.

Alert System: The buzzer is used as an alert mechanism that activates automatically when the measured temperature exceeds the preset threshold.

It provides an immediate audible warning, helping to quickly identify abnormal or fever conditions

Pin connections

BUZZER	ESP32 Pin(GPIO)
Buzzer Positive (+)	GPIO 17
Buzzer Negative (-)	GND

FIGURE 6. BUZZER

Power Management: For an uninterrupted operation a rechargeable 18650 Li-ion battery, PTC fuse, various capacitors, and MT3608 boost are used, for a stable power of 3.3V/5V as the output.

Component Pin	Connects to...
18650 Battery	TP4056
Positive (+)	B+ (on TP4056 module)
Negative (-)	B- (on TP4056 module)

FIGURE 7. LI-ION BATTERY

Charging Circuit: The **TP4056 module** is a **lithium-ion battery charging circuit** used to safely charge and protect the 3.7V Li-ion battery in the system.
It provides **overcharge, overcurrent, and short-circuit protection**, ensuring reliable and stable power supply for the entire device

TP4056 Charger Module	MT3608
OUT+	MT3608 IN+
OUT-	MT3608 IN-

FIGURE 8. TP4056 MODULE

The system integrates essential hardware components such as the ESP8266 microcontroller, MLX90614 sensor, OLED display, Li-ion battery, buzzer, and TP4056 charging circuit, each serving a key role in data sensing, processing, and alerting. Together, these components enable accurate, contactless temperature monitoring with reliable power management and smart alert functionality.

IV. Results and Discussion

In this section, the hardware implementation of the proposed system is explained.

4.1 Hardware Implementation

The hardware implementation of the proposed system. For precise temperature monitoring, the concept combines a non-contact thermal sensor with a microprocessor that can connect to Wi-Fi. The user may see the measured data instantaneously on a small OLED display. A buzzer is included when readings are deemed abnormal. The entire gadget is powered by a 3.7V rechargeable battery, ensuring portability and continuous operation. Every part is safely housed in a portable 3D-printed model, demonstrating functionality and practical application for both personal and medicaluses.

FIGURE 9: HARDWARE IMPLEMENTATION OF THE PROPOSED SYSTEM

TABLE 1: INPUT PARAMETERS

SI.No	Temperature (Input Parameters)	Unit
1.	35.6	°C
2.	36.2	°C
3.	36.8	°C
4.	37.1	°C
5.	37.5	°C

From **Table 1**, it is observed that the input parameters of the system are the temperature values measured by the MLX90614 infrared sensor. These values are in degrees Celsius and represent the body or object temperature. The system collects multiple readings from different patients or locations. The inputs are continuously monitored for real-time processing.

TABLE 2: BODY TEMPERATURE STATUS

SI.No	Temperature Status	Buzzer Indication
1.	Normal	OFF
2.	Normal	OFF
3.	Normal	OFF
4.	Slightly elevated	OFF
5.	Mild fever	ON(Beep Once)

From **Table 2**, the output parameters include the temperature status, such as normal, mild fever, or high fever, based on threshold values. The system activates a buzzer and LED alerts for abnormal temperatures. It also stores the readings for logging and historical analysis. Remote monitoring through cloud dashboards is available as an output feature. The outputs enable timely intervention and ensure patient safety.

TABLE 3: COMPARISON OF THE PROPOSED SYSTEM AND THE CONVENTIONAL SYSTEM WITH THRESHOLD STATUS

Patient ID	Proposed System (°C)	Conventional System (°C)	Threshold Status
P001	35.6	35.8	Normal
P002	36.2	36.4	Normal
P003	36.8	37.0	Normal
P004	37.1	37.2	Slightly Elevated
P005	37.5	37.6	Mild Fever
P006	38.0	38.1	Moderate Fever
P007	38.4	38.3	High Fever
P008	39.0	39.1	High Fever
P009	39.5	39.6	Very High Fever
P010	40.0	39.9	Critical Temperature

Table 3, the comparison of the proposed system and the conventional system with threshold status. From the table, it can be seen that with only a ±0.1°C difference, the comparison demonstrates how well the suggested approach matches the traditional system. Hence, The Proposed contactless temperature monitoring system for real-time patient evaluation has a high degree of accuracy and reliability.

V. COST ESTIMATION

Component	Quantity	Price (₹)
ESP8266 Microcontroller	1	450
MLX90614 Contactless temperature sensor	1	990
0.96 inch OLED Display (I2C)	1	330
18650 Li-ion Battery (Rechargeable)	1	80
TP4056	1	120
Buzzer, switch, glue gun. Components (Wires, Breadboard, Perfboard, Resistors, etc.)	As Required.	250
3D Model (Product Development)	1	2000
Total Estimated Cost Range		4220

VI. CONCLUSION

The proposed IoT-based system of a contactless body temperature scanner is a portable, safe, and amiable real-time health screening device. Without making physical contact, the gadget can precisely monitor body temperature thanks to the ESP8266 Wi-Fi module and the MLX90614 infrared sensor. The output is subsequently transmitted to the Blynk IoT cloud for real-time consumption. The buzzer signal and integrated OLED display improve user involvement and safety by providing instantaneous feedback. Connecting IoT technology to healthcare in this way is economical, effective, and hygienic. We find that it can provide accurate, consistent, and reliable temperature monitoring in public areas like workplaces, educational institutions, railway stations, and airports.

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