SMART IOT EGG INCUBATOR

# MINI PROJECT REPORT

***Submitted by***

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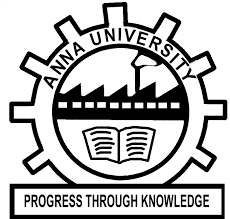
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**In partial fulfillment for the award of the degree**

**BACHELOR OF ENGINEERING**

***in***

**COMPUTER SCIENCE AND ENGINEERING**

**RAJALAKSHMI ENGINEERING COLLEGE**

**ANNA UNIVERSITY: CHENNAI 600 025**

# RAJALAKSHMI ENGINEERING COLLEGE,

# CHENNAI

**BONAFIDE CERTIFICATE**

Certified that this project report titled “**SMART IOT BASED EGG INCUBATOR”** is the bonafide work of **”PRADEEP KUMAR S”** (230701230),**”RAHUL P”**(230701254),

who carried out the work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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# ACKNOWLEDGEMENT

Initially we thank the Almighty for being with us through every walk of our life

and showering his blessings through the endeavor to put forth this report. Our sincere thanks to our Chairman **Mr. S.MEGANATHAN, B.E, F.I.E.,** our Vice Chairman **Mr. ABHAY SHANKAR MEGANATHAN, B.E., M.S.,** and our respected Chairperson **Dr. (Mrs.) THANGAM MEGANATHAN, Ph.D.,** for providing us with the requisite infrastructure and sincere endeavoring in educating us in their premier institution.

Our sincere thanks to **Dr. S.N. MURUGESAN, M.E., Ph.D.,** our beloved Principal for his kind support and facilities provided to complete our work in time. We express our sincere thanks to **Dr. P. KUMAR, M.E., Ph.D.,** Professor and Head of the Department of Computer Science and Engineering for his guidance and encouragement throughout the project work.

We also extend our sincere and hearty thanks to our Internal Guide **Dr.N.Duraimurugan, M.Tech., Ph.D.** Associate Professor, Department of Computer Science and Engineering for his valuable guidance and motivation during the completion of this project. Our sincere thanks to our family members, friends and other staff members of information technology.

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# LIST OF ABBREVIATION

|  |  |
| --- | --- |
| **ABBREVIATION** | **ACRONYM** |
| **IOT** | Internet of Things |
| **HTTP** | HyperText Transfer Protocol |
| **TEMP** | Temperature |
| **DHT** | Digital Humidity and Temperature |
| **API** | Application Program Interface |

# ABSTRACT

This project presents the design and implementation of a Smart IoT-Based Egg Incubator that leverages IoT technology to automate and monitor the incubation process. The system is built around an ESP32 microcontroller, which manages various components including a DHT11 sensor for real-time monitoring of temperature and humidity. A relay module controls an AC motor to rotate the eggs at regular intervals, simulating natural incubation. A high-intensity LED is used as a heating element, providing the necessary warmth to maintain optimal incubation temperature. To prevent overheating, a DC fan is activated when the temperature exceeds a predefined threshold, ensuring a stable environment. The system also features a notification mechanism that alerts users immediately when temperature levels go beyond safe limits. By automating the incubation process and enabling remote monitoring, this IoT-enabled incubator enhances hatch rates, reduces manual dependency, and promotes efficiency in poultry farming practices.

# CHAPTER 1

## INTRODUCTION

## 1.1 INTRODUCTION

## In the evolving domain of modern agriculture, particularly in poultry farming, maintaining precise environmental conditions during the incubation process is crucial for ensuring high hatchability and healthy embryo development. Factors such as temperature, humidity, and egg rotation must be meticulously controlled to replicate the natural conditions required for successful incubation. Deviations in these parameters can adversely affect the hatch rate, resulting in economic losses and compromised productivity.

## With the advent of Internet of Things (IoT) technology, a new paradigm of intelligent automation and real-time monitoring has emerged, offering advanced solutions to overcome traditional challenges in incubation management. The integration of IoT-enabled sensors and microcontrollers allows for continuous tracking of environmental conditions, timely notifications of deviations, and autonomous control of heating and cooling mechanisms. These capabilities significantly enhance the reliability, consistency, and efficiency of the incubation process.

## 1.2 SCOPE OF THE WORK

This project aims to automate and optimize the egg incubation process using smart monitoring and control systems. It ensures ideal environmental conditions by continuously tracking key parameters and taking corrective actions when needed. The system also alerts the user in case of any abnormalities, reducing manual intervention and improving hatch rates. It is especially useful for small to medium-scale poultry operations looking to adopt smart farming practices.

## 

## 1.3 PROBLEM STATEMENT

Traditional egg incubation methods often rely on manual monitoring and control, which can lead to inconsistent conditions and reduced hatch rates. Inaccurate temperature or humidity levels, irregular egg turning, and lack of timely intervention can significantly affect the success of the incubation process. The proposed solution is an intelligent system that continuously monitors environmental conditions, ensures timely egg rotation, and alerts the user when deviations occur—helping to maintain optimal incubation settings and improve efficiency in poultry farming.

## 

## 1.4 AIM AND OBJECTIVES OF THE PROJECT

This project aims to develop a smart egg incubator system that ensures optimal

hatching conditions through automation and real-time monitoring. The objectives include designing a reliable system for monitoring incubation parameters, automating control actions based on sensor data, and alerting users when environmental conditions deviate from the ideal range. The project also focuses on improving hatch rates, reducing manual effort, and providing an efficient solution for small-scale poultry farmers.

# CHAPTER 2

## SYSTEM SPECIFICATIONS

## 2.1 IOT DEVICES

1. ESP8266-12E NODEMCU with Wi-Fi Module
2. DHT11 Sensor
3. Relay Module
4. DC Fan
5. AC Motor
6. Led Light

## 2.2 SYSTEM HARDWARE SPECIFICATIONS

|  |  |
| --- | --- |
| PROCESSOR | Intel i3 11th Gen |
| MEMORY SIZE | 8 GB (Minimum) |
| HDD | 40 GB (Minimum) |

## 2.3 SOFTWARE SPECIFICATIONS

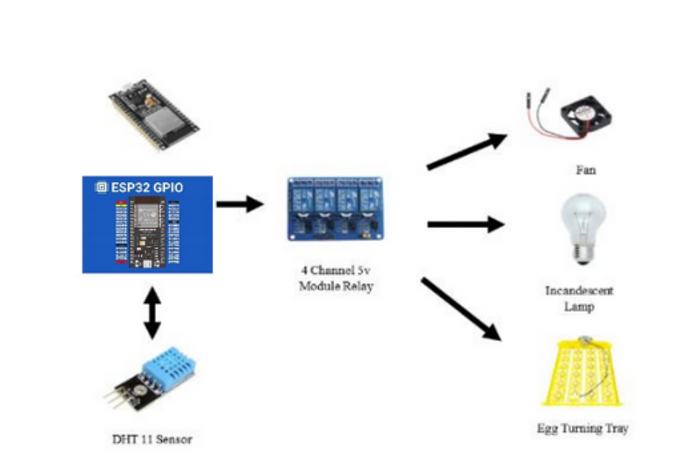
|  |  |
| --- | --- |
| Operating System | Windows 11 |
| XBrowser | Google Chrome |
| IDE | Arduino |

# CHAPTER 3

# SYSTEM DESIGN

## 3.1 ARCHITECTURE DIAGRAM

An architecture diagram is a graphical representation of a set of concepts, that are part of an architecture, including their principles, elements and components



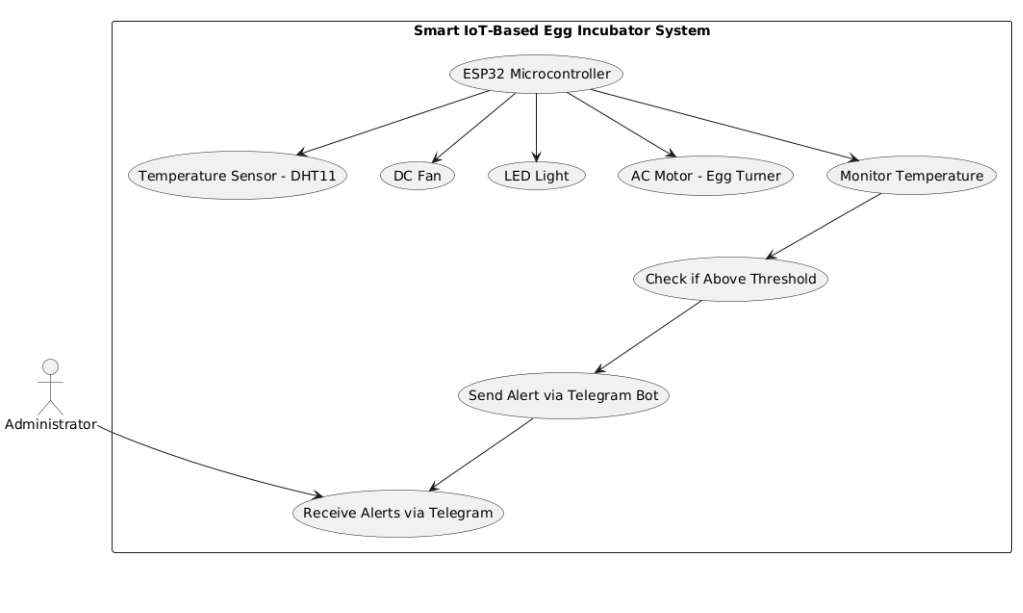


**Figure 3.1** Architecture Diagram

From the above Figure 3.1, the architecture of the system is well understood.

## 3.2 USE CASE DIAGRAM

A use case is a list of actions or event steps typically defining the interactions between a role (known in the Unified Modelling Language as an actor) and a system to achieve a goal. The actor can be a human or other external system.

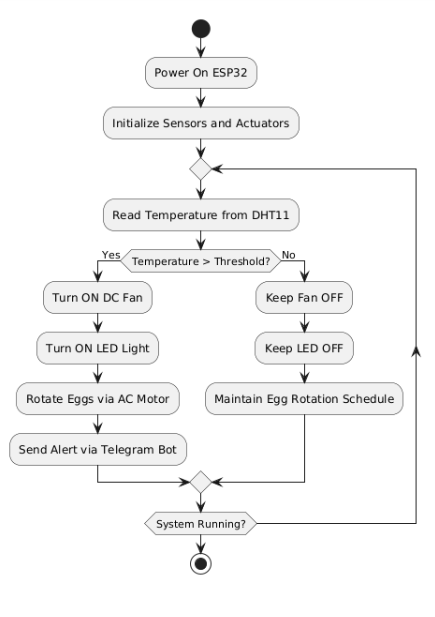


**Figure 3.2** Use case diagram

From the above figure 3.2, the interactions between a role in the system is shown

**3.3 ACTIVITY DIAGRAM**

An activity in Unified Modelling Language (UML) is a major task that must take place in order to fulfill an operation contract. Activities can be represented inactivity diagrams. An activity can represent: The invocation of an operation. A step in a business process.

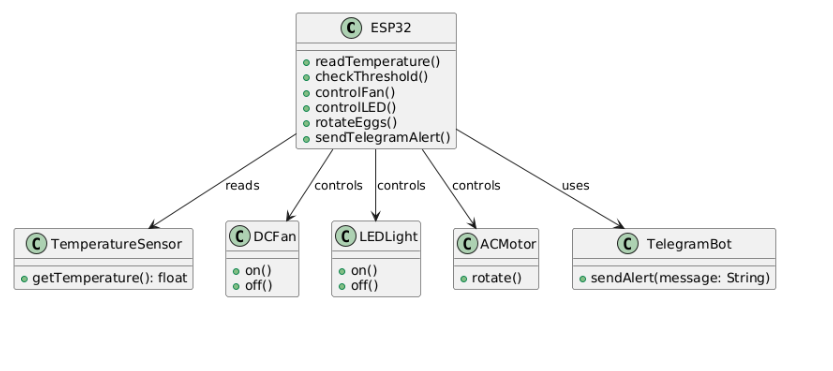


**Figure 3.3** Activity Diagram

From the above figure 3.3, the activities of the system are shown

## 3.4 CLASS DIAGRAM

A class diagram is an illustration of the relationships and source code dependencies among classes in the Unified Modelling Language (UML). In this context, a class defines the methods and variables in an object, which is a specific entity in a program or the unit of code representing that entity.



**Figure 3.4** Class Diagram

The above Figure 3.4 is the class diagram for the system.

# CHAPTER 4

# MODULE DESCRIPTION

## 4.1 HARDWARE MODULE:

## This module consists of the ESP32 microcontroller, which serves as the brain of the system, along with key hardware components such as the temperature sensor (DHT11), DC fan, LED light, and an AC motor for egg rotation. The DHT11 sensor continuously monitors the internal temperature of the incubator. When the temperature exceeds a predefined threshold, the ESP32 triggers the DC fan and LED light to stabilize the environment and maintain optimal hatching conditions. The AC motor is periodically activated to rotate the eggs, mimicking the natural turning process. Additionally, a Telegram Bot is integrated to provide real-time alerts to the user when temperature abnormalities are detected, ensuring proactive management of the incubation process.

## 4.2 DATA COLLECTION AND PROCESSING MODULE:

## This module collects real-time temperature data from the DHT11 sensor using the ESP32 microcontroller. It processes the data locally to check if the temperature exceeds the set threshold. If a deviation is detected, the system activates the necessary components (fan, light, motor) and sends an alert via the Telegram Bot.

## 4.3 ALERTING MODULE:

# Monitors real-time temperature data from the incubator’s temperature sensor. If the temperature exceeds or falls below the predefined threshold, it triggers an alert via a Telegram bot notification. This ensures the user is promptly notified about any critical temperature changes, allowing for timely intervention to prevent potential harm to the eggs being incubated.

# CHAPTER 5

# SAMPLE CODING

**Program**

#include <WiFi.h>

#include <HTTPClient.h>

#include <DHT.h>

// WiFi credentials

const char\* ssid = "Moon";

const char\* password = "nisha2005";

// Telegram Bot credentials

String BOT\_TOKEN = "7542238511:AAEiWqVWQ1na8v0CA3SEvxZREH0EHdHnVEw";

String CHAT\_ID = "964596340";

// Pins

#define DHTPIN 4

#define DHTTYPE DHT11

#define RELAY\_LED 18

#define RELAY\_MOTOR 5

DHT dht(DHTPIN, DHTTYPE);

// Motor timer variables

unsigned long previousMillis = 0;

const unsigned long motorOnTime = 2 \* 60 \* 1000;   // 2 minutes

const unsigned long motorOffTime = 1 \* 60 \* 1000;  // 1 minute

bool motorIsOn = false;

// Telegram notification flag

bool tempAlertSent = false;

void setup() {

  Serial.begin(115200);

  pinMode(RELAY\_LED, OUTPUT);

  pinMode(RELAY\_MOTOR, OUTPUT);

  digitalWrite(RELAY\_LED, HIGH);    // OFF

  digitalWrite(RELAY\_MOTOR, HIGH);  // OFF

  WiFi.begin(ssid, password);

  Serial.print("Connecting to WiFi");

  while (WiFi.status() != WL\_CONNECTED) {

    delay(500);

    Serial.print(".");

  }

  Serial.println("\nWiFi Connected!");

  dht.begin();

}

void loop() {

  unsigned long currentMillis = millis();

  // Motor ON/OFF logic

  if (motorIsOn && currentMillis - previousMillis >= motorOnTime) {

    digitalWrite(RELAY\_MOTOR, HIGH);  // Turn motor OFF

    Serial.println("Motor OFF");

    motorIsOn = false;

    previousMillis = currentMillis;

  }

  else if (!motorIsOn && currentMillis - previousMillis >= motorOffTime) {

    digitalWrite(RELAY\_MOTOR, LOW);   // Turn motor ON

    Serial.println("Motor ON");

    motorIsOn = true;

    previousMillis = currentMillis;

  }

  // Temperature reading

  float temperature = dht.readTemperature();

  if (isnan(temperature)) {

    Serial.println("Failed to read from DHT sensor!");

  } else {

    Serial.print("Temperature: ");

    Serial.println(temperature);

    // LED & Telegram logic

    if (temperature > 37.5) {

      digitalWrite(RELAY\_LED, HIGH); // LED OFF

      Serial.println("LED OFF (Temp > 37.5°C)");

      if (temperature > 40.0 && !tempAlertSent) {

        sendTelegramAlert(temperature);

        tempAlertSent = true;

      }

    } else {

      digitalWrite(RELAY\_LED, LOW); // LED ON

      Serial.println("LED ON (Temp <= 37.5°C)");

      tempAlertSent = false;

    }

  }

  delay(5000);  // Delay before next loop

}

void sendTelegramAlert(float temp) {

  if (WiFi.status() == WL\_CONNECTED) {

    HTTPClient http;

    String message = "🔥 ALERT: Temperature is " + String(temp) + "°C";

    String url = "https://api.telegram.org/bot" + BOT\_TOKEN +

                 "/sendMessage?chat\_id=" + CHAT\_ID +

                 "&text=" + message;

    Serial.println("Sending to: " + url);  // 👈 Debug URL

    http.begin(url);

    int httpResponseCode = http.GET();

    Serial.print("HTTP Response code: ");

    Serial.println(httpResponseCode);

    http.end();

  } else {

    Serial.println("WiFi not connected.");

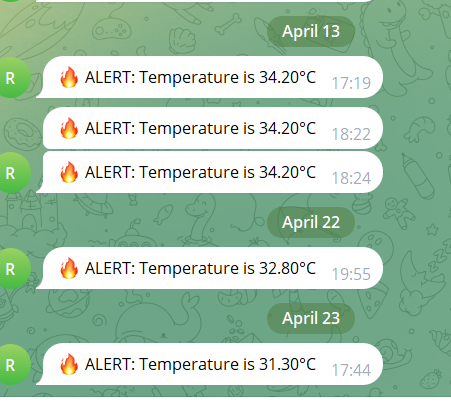
  }

}

# CHAPTER 6

# SCREEN SHOTS

**1. Data Sent from ESP32 to Telegram Bot**



**Figure 6.1** Data Received by Telegram bot from ESP32

# CHAPTER 7

## CONCLUSION AND FUTURE ENHANCEMENT

The IoT-based smart egg incubator system represents a significant advancement

in monitoring and controlling the incubator environment, ensuring optimal

conditions for egg hatching. By integrating temperature sensors, real-time

monitoring, and automated alerts through a Telegram bot, the system provides

users with reliable notifications about any temperature fluctuations, facilitating

quick responses to prevent harm to the eggs. This intelligent system not only

enhances the efficiency of egg incubation but also minimizes human

intervention, ensuring the best possible hatching outcomes.

# Future developments can focus on improving the system’s precision and

# expanding its capabilities. Enhancing the accuracy of the temperature sensor and

# integrating additional environmental sensors (e.g., humidity or CO2 sensors)

# can provide a more comprehensive monitoring system. The incorporation of

# machine learning algorithms can help predict temperature spikes or drops based

# on historical data, further improving the system’s responsiveness. Additionally,

# expanding the notification system to include multiple channels, such as email or

# SMS, could provide users with even more flexibility in receiving alerts.

# Integration with mobile applications for remote monitoring and control could

# increase accessibility, allowing users to manage the incubator from anywhere.

# Furthermore, integrating a backup power system could ensure uninterrupted

# operation in the event of power failures, ensuring the safety of the incubator

# environment at all times.

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