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**CHAPTER 1**

**INTRODUCTION**

In this modern era we have various technologies to make our day easier, one such thing is integrating, internet of things in our daily activity for ensuring efficient delivery and accessibility. With the advancement of technology, the Internet of Things (IoT) is emerging as a platform which makes human work easier,by revolutionizing various aspects of our daily lives. One area which made IoT a great success is home automation, where smart devices can enhance convenience, efficiency, and control. Here, in our project we focus on developing an IoT-based control system for water heaters, aimed at optimizing energy consumption and improving user experience. Traditional water heaters operate on fixed schedules or require manual controls, often resulting in energy wastage and inconvenience for users. However, by integrating IoT with water heater systems, by introducing these intelligent features we can adapt to user preferences and environmental conditions.

Oue core idea of this project is to use IoT technologies to create a smart water heater which offers remote access, automated scheduling, and energy-efficient operation. By connecting the sensors, actuators, and connectivity features,we can monitor our system and adjust water heating processes in real-time, based on the factors such as ambient temperature, and user preferences. We can also access the mobile applications or web portals which are user-friendly, users can remotely monitor and control their water heaters. They can set desired temperature levels, schedule heating cycles according to their daily routines, and we receive notifications about system status by which we can modify the system and energy consumption.

The main benefits of our IoT-based water heater control system have different parts,forms and features. Firstly, it provides many benefits to the users to optimize energy usage, thereby reducing utility bills and environmental impact. Secondly, it provides convenience by allowing remote control and monitoring, enabling users to have hot water according to their needs. Lastly, by incorporating data analytics and machine learning algorithms, the system can learn continuously and adapt to user behavior, further improving the efficiency and providing user satisfaction over time. In summary, our project aims to showcase the idea which provides an automated environment of IoT technology in the realm of household appliances, specifically water heaters. By creating a smart, connected system, we create a future where energy-efficient and user-friendly solutions become the norm, ultimately contributing to sustainability and enhanced quality of life.

**CHAPTER 2**

**LITERATURE SURVEY**

[1] This work introduces a new paradigm of monitoring student attendance using Radio Frequency Identification (RFID) based on the Internet Of Things(IoT). Educational institutes are concerned about student irregular attendance. Truancy can affect a student's overall academic performance. The traditional method of taking attendance by calling names or signing on paper is very time

consuming and inefficient. RFID-based attendance system using an IoT system is one of the solutions to handle the problem. The proposed work comprises of two most popular trends in technology research; IoT and RFID. [2] The current scenario where the students are expected to answer their call is still prevalent and has not changed with many such developed technologies. The attendance systems in colleges and universities are still manual. Lecturers take attendance and later update it in excel or a database. If we talk about technology then we found that there are a lot of tools to use and reduce the burden of lectures. Using RFID is one example of that. We if combine the RFID and IoT (Internet of Things) then we can do it automatically and there is no need to do it by lectures. Here we are planning to use the Cloud as storage for better performance. Using IoT and Cloud we can access it from anywhere and anytime which will provide us the better proficiency and flexibility. [3] Attendance is a must for students. Without the attendance process, the lecturer or teacher cannot assess the participation of a student. But in the process now, attendance is still done manually using paper. The first problem is the use of excess paper and the second problem is the difficulty for the administration to recapitulate student attendance results. This is because so many attendance papers must be analyzed by the administration. Therefore, a student attendance system is needed that can collect data quickly, efficiently, and accurately. This student attendance system is done by conducting data collection, system analysis, system design, and system implementation. This system is created using the PHP and Java Android programming languages. The System is also using Ibeacon as a classroom identifier. The purpose of this study is to make attendance system applications for students and class schedule notifications based on IBEACON, it is expected that the attendance process will be more efficient and can be easily monitored by lecturers and by the central administration. Biometric system that reads fingerprints to monitor attendance in an institution. But these systems aren’t efficient and safe considering the

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post-Covid pandemic. There are also several projects and existing models that use barcodes for this attendance tracking. Smartphones can also be used for this purpose but, it seems there are chances to make fraudulent access to the system. Many types of the research proposed video and image-based automated monitoring where it’s not economically feasible and depending on the location of the camera, and the posture of the student sometimes it may fail when there are two or more students with similar facial features.

**2.1 EXISTING SYSTEM**

The existing system for IoT-based water heaters typically involves integrating sensors, controllers, and connectivity modules into traditional water heater systems. These IoT devices monitor various parameters such as water temperature, usage patterns, and energy consumption, allowing for remote control and automation via a smartphone app or web interface. Users can adjust settings, schedule heating cycles, and receive alerts for issues like leaks or malfunctions. Additionally, some systems utilize machine learning algorithms to optimize energy usage and predict maintenance needs, enhancing efficiency and reliability. Overall, IoT-based water heaters offer increased convenience, energy savings, and peace of mind for users through smart monitoring and control capabilities.

**CHAPTER 3**

**PROJECT DESCRIPTION**

Our IoT-based water heater project is designed to revolutionize traditional water heating systems by integrating cutting-edge Internet of Things (IoT) technology. Through this innovative approach, our system transforms ordinary water heaters into intelligent devices capable of real-time monitoring, control, and optimization. By leveraging IoT sensors and connectivity, users gain remote access to their water heaters via a smartphone app or web interface. This enables them to adjust temperature settings, schedule heating cycles, and receive alerts for maintenance or anomalies, enhancing user convenience and control. Moreover, our system prioritizes energy efficiency through advanced algorithms that analyze data from sensors and external sources to optimize heating schedules and temperature settings, minimizing energy wastage while ensuring hot water availability. Additionally, integrated leak detection sensors provide early warning of potential leaks, allowing for timely intervention to prevent property damage and conserve water. With predictive maintenance capabilities and seamless integration into smart home ecosystems, our IoT-based water heater offers a comprehensive solution for efficient, convenient, and sustainable water heating.

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**3.1 PROPOSED SYSTEM**

The proposed system for IoT-based water heaters aims to enhance functionality and efficiency by integrating advanced technologies. It involves the incorporation of sensors for real-time monitoring of water temperature, flow rate, and quality, coupled with connectivity modules for remote access and control. Additionally, the system would feature predictive maintenance algorithms to anticipate potential issues and optimize performance. Furthermore, integration with smart home ecosystems and energy management platforms would enable seamless coordination with other devices and efficient energy utilization. Ultimately, this comprehensive approach ensures enhanced user experience, improved energy savings, and minimized downtime for IoT-based water heating systems.

**3.2 REQUIREMENTS**

**3.2.1 HARDWARE REQUIREMENTS**

• ESP32 WROOM

• RELAY MODULE

• PIR SENSOR

• DS18B20 TEMPERATURE SENSOR K-TYPE

• BREADBOARD

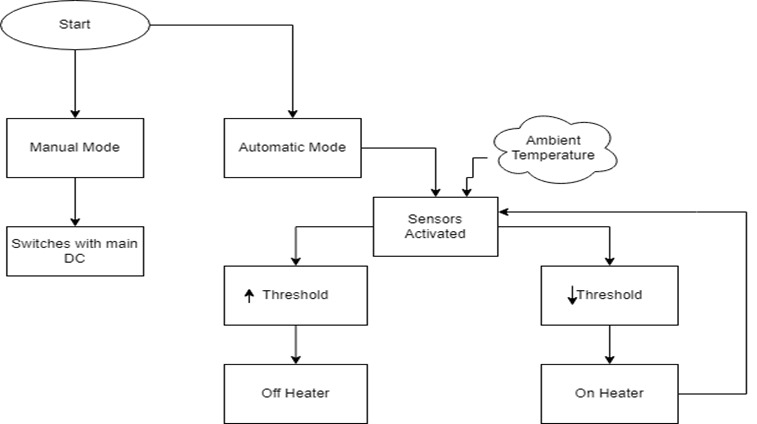
• CONNECTING CABLES

**3.2.2 SOFTWARE REQUIREMENTS**

• ARDUINO IDE

• BLYNK IOT

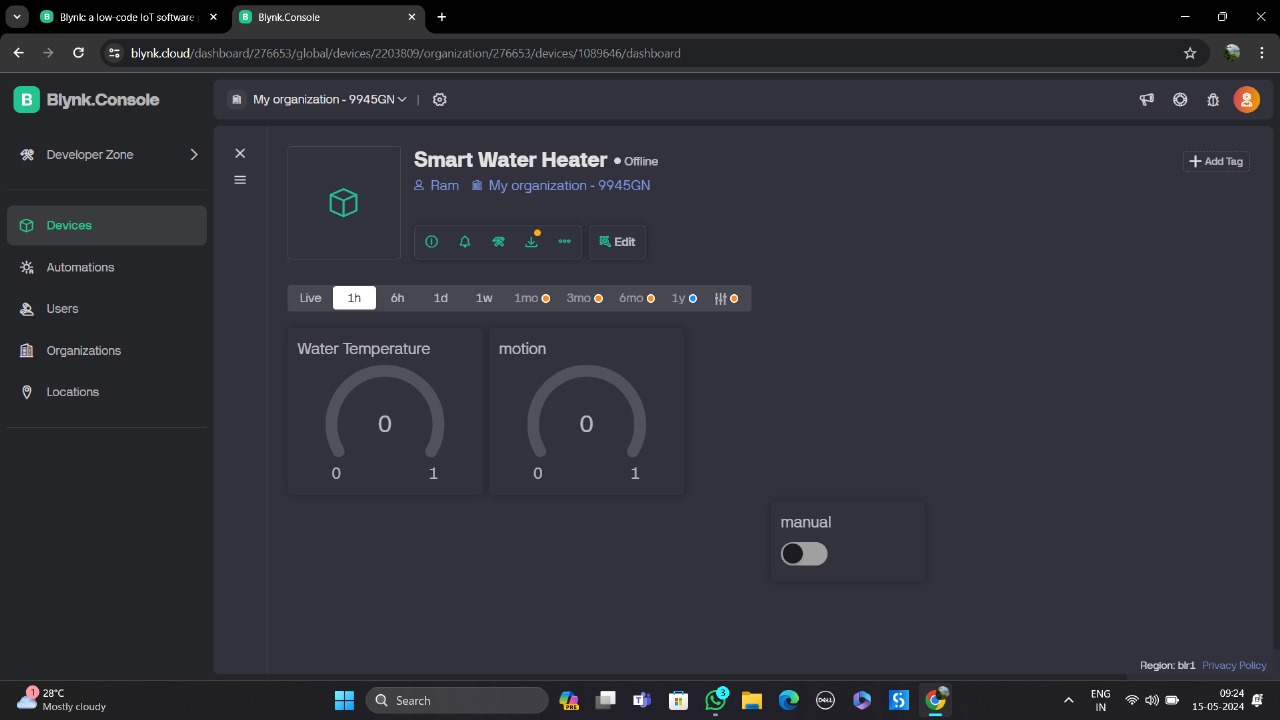
**3.3 ARCHITECTURE DIAGRAM**



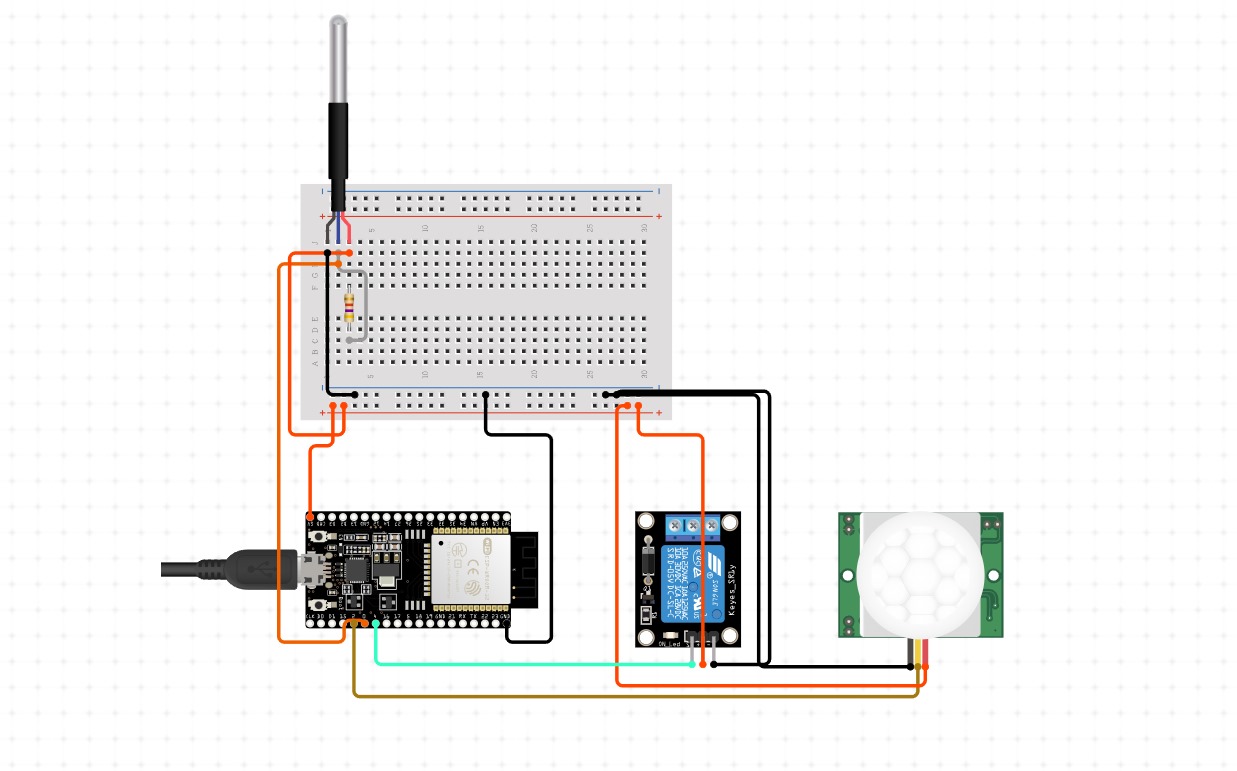
**Figure 2**

**3.4 OUTPUT**

**CONNECTIONS**



**CIRCUIT DIAGRAM**



**CHAPTER 4**

**CONCLUSION AND FUTURE WORK**

In conclusion, in our IoT-based water heater project we represent a great idea in residential water heating technology, offering optimal levels of efficiency, convenience, and sustainability. By providing the power of internet connectivity,using advanced sensors, and applying intelligent algorithms, this innovative system allows the users to remotely monitor and provide control of their water heaters, optimize the energy used by users, and which enhances the safety through features like predictive heating control, demand response, and real-time data analysis. With a focus on customization, integration, and sustainability, our project covers not only the way we heat water but also sets a precedent for smart appliances, interconnected homes of the future, where comfort, efficiency, and environmental responsibility converge seamlessly.

For future enhancements of the IoT-based water heater project, we are integrating machine learning algorithms which could further refine predictive heating control, enabling the system to adapt to users' needs which are evolving the preferences and behaviors of the users dynamically. Developed integration with resources that have renewable energy, such as solar panels or heat pumps can be used to optimize energy usage and reduce the need of users to depend on power grids, providing greater sustainability. Additionally, implementation of the blockchain technology for secure, centralized data storage and transactions could provide privacy and security while enabling one-to-one energy trading between homeowners. Moreover, we can explore the potential for advanced sensors and artificial intelligence to detect and mitigate water leaks or malfunctions in real-time would further enhance safety and minimize water wastage. Overall, these enhancements would drive the project towards greater efficiency, resilience, and user-centric innovation in the evolving landscape of smart home technology.

**APPENDIX I**

#include <WiFi.h>

#include <WiFiClient.h>

#include <BlynkSimpleEsp32.h>

#include <Wire.h>

#include <OneWire.h>

#include <DallasTemperature.h>

// WiFi credentials

const char\* ssid = "YOUR\_WIFI\_SSID";

const char\* password = "YOUR\_WIFI\_PASSWORD";

char auth[] = "YOUR\_BLYNK\_AUTH\_TOKEN";

// Pin definitions

#define RELAY\_PIN 26

#define PIR\_PIN 27

#define ONE\_WIRE\_BUS 14 // DS18B20 data pin

// Setup OneWire instance to communicate with any OneWire devices (like DS18B20)

OneWire oneWire(ONE\_WIRE\_BUS);

DallasTemperature sensors(&oneWire);

// Global variables

volatile unsigned long previousMillis = 0;

const long interval = 5000; // Check temperature every 5 seconds

float temperatureLimit = 25.0; // Change this to your desired temperature limit

void setup() {

Serial.begin(115200);

// Connect to WiFi

WiFi.begin(ssid, password);

Serial.print("Connecting to WiFi");

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

delay(500);

Serial.print(".");

}

Serial.println("WiFi connected");

// Initialize Blynk

Blynk.begin(auth, ssid, password);

// Start up the DS18B20 sensor

sensors.begin();

// Call function when something changes

Blynk.virtualWrite(V5, 0);

}

void loop() {

Blynk.run();

// Read PIR sensor

int motionDetected = digitalRead(PIR\_PIN);

if (motionDetected == HIGH) {

Serial.println("Motion detected!");

digitalWrite(RELAY\_PIN, HIGH); // Turn on the relay

Blynk.virtualWrite(V1, 255); // Update Blynk app

Blynk.notify("Motion detected!"); // Send notification

} else {

digitalWrite(RELAY\_PIN, LOW); // Turn off the relay

Blynk.virtualWrite(V1, 0); // Update Blynk app

}

// Read temperature

unsigned long currentMillis = millis();

if (currentMillis - previousMillis >= interval) {

// Update previousMillis

previousMillis = currentMillis;

// Request temperature

sensors.requestTemperatures();

float temperature = sensors.getTempCByIndex(0);

Serial.print("Temperature: ");

Serial.println(temperature);

// Update Blynk app

Blynk.virtualWrite(V3, temperature);

// Check if temperature exceeds the limit

if (temperature >= temperatureLimit) {

Blynk.notify("Temperature limit exceeded!"); // Send notification

}

}

}

BLYNK\_WRITE(V4) { // Virtual pin to control the relay from the app

int relayState = param.asInt();

digitalWrite(RELAY\_PIN, relayState);

}

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