Mini Project Report

on

IoT Based AC Remote Control using Node MCU

Submitted in the partial fulfillment of the requirements

for the degree

Bachelor in Technology

by

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Certificate

This is to certify that the Mini project report **entitle IoT Based AC Remote Control using Node MCU** is bonafide record of the work done by **Smriti Singh, Yash Patil, Adwait Sumbh, Shivam Sharma** in the year 2022-23 under the guidance of **Prof. Dipak Kulkarni & Dr. Rupali Patil** in partial fulfillment of requirement for the Bachelor in Technology degree in **Electronics and Telecommunication Engineering** of Somaiya Vidyavihar University.

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Abstract

This study presents an IoT-based AC remote control system using NodeMCU, which enables users to remotely control their AC units through the Internet using a mobile app or web-based interface. The use of IoT technology has significantly impacted home automation systems and has led to the development of advanced control systems that make life more comfortable and convenient. In this project, we aimed to design an IoT-based AC remote control system that can be easily integrated with other IoT devices and systems, and also offer a simple and eco-friendly way of managing AC units.

To make the system more user-friendly, we developed a mobile app and a web-based interface that allows users to remotely control their AC units from anywhere in the world. The app and interface are designed to be intuitive and easy to use, with features such as temperature control, pre-set temperature values, and turning the ac on and off.

The system was tested extensively, and the results were satisfactory. The AC unit responded promptly to the commands sent through the mobile app and web-based interface. The system can be highly adaptable, as it is compatible with any ac unit which has an IR Receiver.

In terms of energy efficiency, the system has several advantages. The mobile app allows users to set the AC unit to turn on and off at specific times, reducing energy consumption and saving costs. Additionally, the system uses low-power IoT technology, which consumes minimal power and reduces the overall energy consumption of the system.

In this report, an exhaustive study on IoT Based AC Remote Control using Node MCU is presented.

***Keywords*:** IoT, Node MCU, AC, Remote Control, Mobile App.

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Chapter 1: Introduction

This chapter presents the introduction of an IoT-based solution to control an air conditioner through a mobile app. The system uses a NodeMCU board with a DHT11 temperature and humidity sensor to monitor the room temperature and provide feedback to the system. The mobile app allows the user to turn the air conditioner on and off, adjust temperature settings,

1.1 Background

The Internet of Things (IoT) is a rapidly growing field that involves the interconnection of various devices and systems through the Internet. One popular application of IoT technology is the remote control of household appliances, such as air conditioners. In this scenario, a NodeMCU board, which is a popular development board based on the ESP8266 Wi-Fi chip, is used as the IoT device to control the air conditioner.

The NodeMCU board does not have a relay built-in, but it can still be used to control a relay module that can turn the air conditioner on and off. Additionally, the board is equipped with a DHT11 temperature and humidity sensor, which can be used to monitor the room temperature and provide feedback to the system.

The mobile app is used to communicate with the NodeMCU board over Wi-Fi, allowing the user to control the air conditioner from their smartphone. The app provides basic controls such as turning the air conditioner on and off, as well as the ability to adjust the temperature settings. The app also includes pre-set temperature buttons, which allow the user to quickly set the desired temperature without having to manually adjust the settings.

Overall, this setup provides a convenient and efficient way to control the air conditioner from anywhere using a smartphone, while also monitoring the room temperature to ensure optimal comfort.

1.2 Motivation

The motivation behind developing an IoT-based air conditioner remote control system is to provide a convenient and efficient way for users to control their air conditioner from anywhere using a mobile app. This system eliminates the need for users to physically interact with the air conditioner, which can be particularly useful in situations where the air conditioner is in a hard-to-reach location or the user is not in the same room as the air conditioner.

Moreover, the system's temperature monitoring feature using the DHT11 sensor ensures that the user can maintain a comfortable temperature in the room without having to constantly adjust the settings. The pre-set temperature buttons also provide a quick and easy way to set the desired temperature without having to manually adjust the settings.

Overall, the motivation behind this system is to provide users with greater control and convenience when it comes to managing their air conditioner, while also ensuring optimal comfort through temperature monitoring and pre-set temperature settings.

1.3 Scope of the Project

The scope of using the IoT-based air conditioner remote control system is to provide a convenient and efficient way for users to control their air conditioner from anywhere using a mobile app. This system can be useful in various settings, including:

1. Residential homes: The system can be used by homeowners to remotely control their air conditioner and maintain a comfortable temperature in their homes.
2. Offices: The system can be used in office settings to provide employees with a more comfortable working environment.
3. Hospitals: The system can be used in hospital settings to control the temperature of patient rooms and provide optimal comfort.

Overall, the scope of this project is to provide a flexible and convenient solution for air conditioner control in a variety of settings.

Chapter 2: Literature Survey

In this literature review, an overview of the current research on home automation using IoT technology, its applications, and its impact on making human life easier and more relaxing. Here we reviewed 4 Research papers and provided our personal remarks

[1] The article titled "AnyControl – IoT-based Home Appliances Monitoring and Controlling" describes the design and implementation of a home automation system that uses IoT technology for monitoring and controlling household appliances. The authors have identified a significant need for better monitoring and control of household appliances to reduce energy consumption and improve overall efficiency, and their proposed solution could have a significant impact on the energy consumption patterns of households. However, one limitation of this paper is that it does not provide a comprehensive analysis of the economic and social implications of the system. The authors mainly focus on the technical aspects of the design and implementation and do not provide much discussion on the broader societal implications of the system. They have reported that their system achieved accurate monitoring and control of household appliances, as well as significant energy savings.

[2] The article titled "Smart Air Conditioner Controller Integrated with Temperature and Humidity Sensor" published in IEEE presents a practical and innovative solution for improving the energy efficiency of air conditioning systems. The authors have incorporated intelligent control strategies and real-time sensing capabilities into the air conditioning system to optimize the temperature and humidity levels based on the actual environmental conditions. The integration of intelligent control strategies and real-time sensing capabilities in air conditioning systems can significantly reduce energy consumption and improve occupant comfort, which is an important consideration in the context of sustainable building design. The authors have also presented their findings and results clearly and concisely, which makes it easy for readers to understand and replicate the study. The paper provides a detailed description of the hardware and software components used in the design and implementation of the system. The authors also explain the methodology used for testing and evaluation and report significant energy savings of up to 30% compared to traditional air conditioning systems.

[3] The article titled "Prototyping Design of IR Remote Controller for Smart Home Applications" describes the design and prototyping of an IR remote controller for smart home applications. The authors present a detailed description of the hardware and software components used in the system, including the microcontroller, IR receiver, and communication protocols. The authors have identified the need for a simple and cost-effective solution for controlling smart home devices, and their proposed IR remote controller could have a significant impact on the adoption of smart home technology among consumers. However, one limitation of this paper is that it does not provide a comprehensive analysis of the economic and social implications of the system. They have reported that their system achieved accurate control of smart home devices, and the results demonstrate the feasibility and effectiveness of their proposed solution.

[4] The article titled "Prototyping Design of Electronic End-Devices for Smart Home Applications" presents a detailed description of the design and prototyping of electronic end-devices for smart home applications. The authors have identified the need for a low-cost and easy-to-use solution for controlling smart home devices, and their proposed electronic end devices could have a significant impact on the adoption of smart home technology among consumers. They have also reported that their proposed end devices achieved accurate and reliable control of smart home devices, and the results demonstrate the feasibility and effectiveness of their proposed solution. Another strength of this paper is the focus on the economic and social implications of the system. The authors have discussed the potential cost savings and environmental benefits of using their electronic end devices for controlling smart home devices, which could have significant implications for consumers and society as a whole. Overall, this paper is a valuable contribution to the field of smart home applications and provides useful insights into the design and prototyping of electronic end devices for controlling smart home devices. It is recommended for researchers and practitioners who are interested in developing low-cost and easy-to-use solutions for smart home technology.

Chapter 3: Logical Analysis

3.1 Introduction

IoT (Internet of Things) is a rapidly growing technology that has transformed the way we interact with devices and appliances in our daily lives. One of the most popular IoT applications is the remote control of household appliances, such as air conditioners. An IoT-based AC controller using NodeMCU is a system that enables remote control of an AC unit through a web application. By using the NodeMCU board and an IR sensor, the user can send commands to the AC unit remotely through the internet, such as turning the unit on/off, adjusting the temperature, and scheduling when the unit should be turned on/off. The system is cost-effective, easy to install and use, and scalable to handle multiple AC units. This technology has brought about a new level of convenience and flexibility to our daily lives and has the potential to revolutionize the way we interact with our appliances.

3.1.1 Project Background

The project "IoT Based AC Remote Control using Node MCU" is a device that allows the user to remotely control their air conditioning system using their mobile phone or computer. The project uses a Node MCU board, which is a small Wi-Fi enabled.

In addition, the project utilizes a DHT11 sensor to monitor the temperature and humidity of the room environment, allowing the user to adjust the AC settings accordingly to maintain a comfortable indoor environment. The device has basic functions such as on/off and temperature control using the mobile application.

This project aims to create a cost-effective and convenient solution for users to remotely control their AC systems while also promoting energy efficiency by monitoring the room environment and adjusting the AC settings accordingly.

3.1.2 Project Requirements:

1] WiFi Connection: A stable WiFi Connection to always keep the Node MCU connected with BLYNK Cloud Services.

2] AC Remote: AC Remote is needed to get the HEX values which can be further used to control the AC unit.

3] Smart Phone: A Smartphone with a BLYNK platform installed and a stable internet connection.

3.1.3 Application Requirements:

Compatible operating system: Andriod 7.0 or Above / IOS 10.0 or Above

Language Used: C++

Technology Used: IoT

Editor Tools –Arduino IDE, Notepad++

Web Browser-Google Chrome, Firefox, or any compatible update browser.

3.1.4 Hardware Requirements:

NodeMCU Board - It is a development board based on the ESP8266 WiFi chip. It has an onboard WiFi module that enables it to connect to the internet and communicate with other devices. It has 11 digital input/output pins, one analog input pin, and a USB interface for programming and power supply.

TSOP 1738 IR Receiver - It is a sensitive IR receiver that is used to receive signals from an infrared remote. It has a built-in amplifier and demodulator that convert the modulated IR signal into a digital signal that can be processed by the microcontroller.

IR LED - It is a light-emitting diode that emits infrared radiation when a current is passed through it. It is used to transmit the signals to the AC unit, which are received by the IR receiver of the AC unit.

DHT11 Temperature and Humidity Sensor - It is a low-cost digital sensor that is used to measure room temperature and humidity. It has a capacitive humidity sensor and a thermistor that provide the temperature and humidity values respectively.

Breadboard - A breadboard is a board made of plastic or other insulating material that has numerous holes drilled into it. These holes are used to insert electronic components such as resistors, capacitors, transistors, and so on. A breadboard allows you to connect electronic components without soldering them. Instead, you insert the components into the holes and connect them using jumper wires.

3.2 Problem Statement:

Air conditioning is a common appliance used in many homes and offices. However, controlling the AC unit remotely can be a challenge, especially when the user is not in the same room as the AC unit. The traditional way of controlling the AC unit through a remote controller has limitations, such as the need to be within a certain range and the possibility of losing or misplacing the remote controller.

The problem statement is to design and develop an IoT-based AC controller using NodeMCU that will allow the user to control the AC unit remotely through a web application. The solution should be easy to install and operate, and it should be cost-effective. Additionally, the system should be reliable, secure, and scalable to handle multiple AC units.

3.3 Block Diagrams:

3.3.1 Flow Chart:

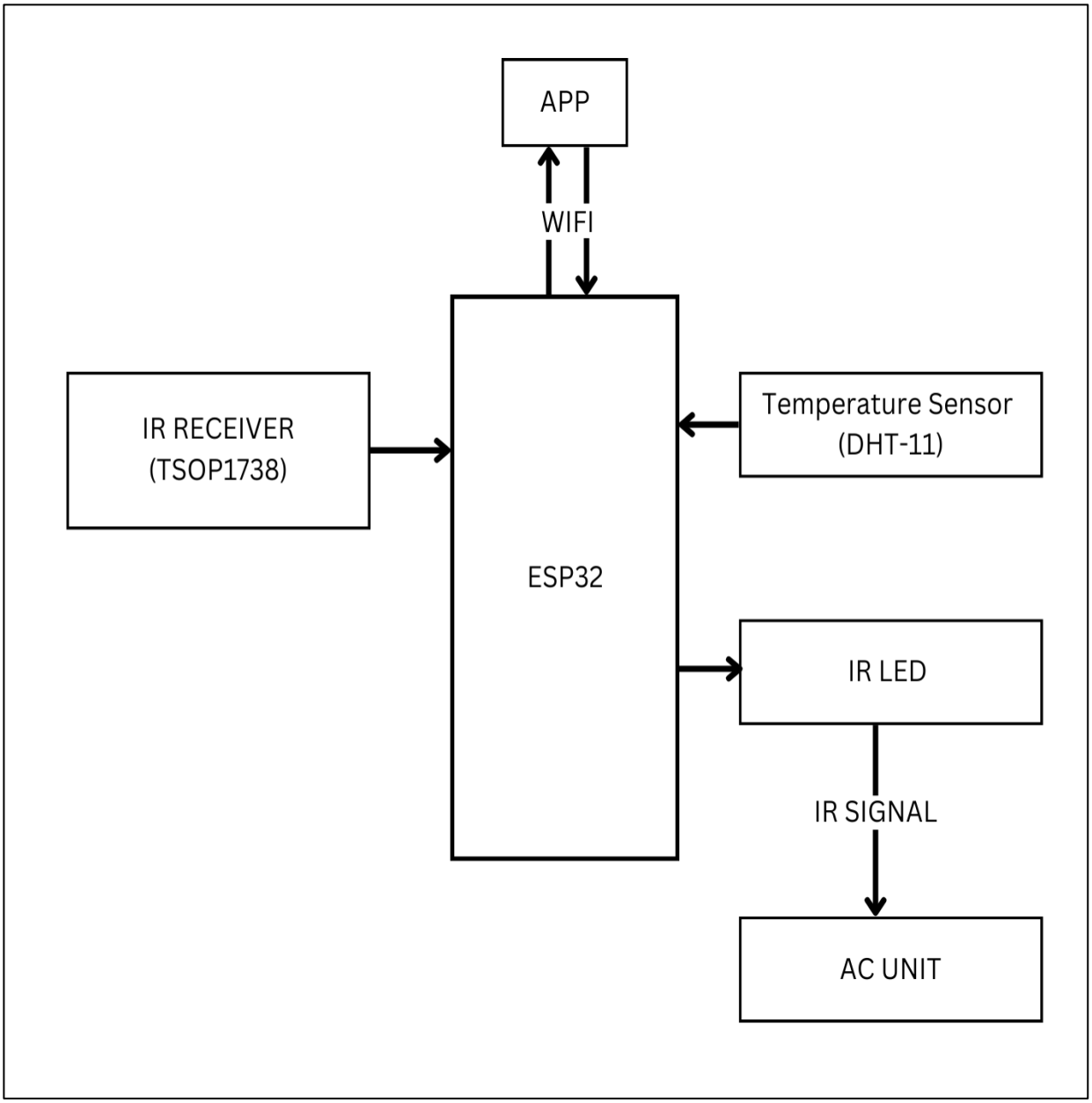

Figure 1: Flowchart of Communication between sensors, ESP32, and Cloud server

3.3.2 Circuit Diagram:

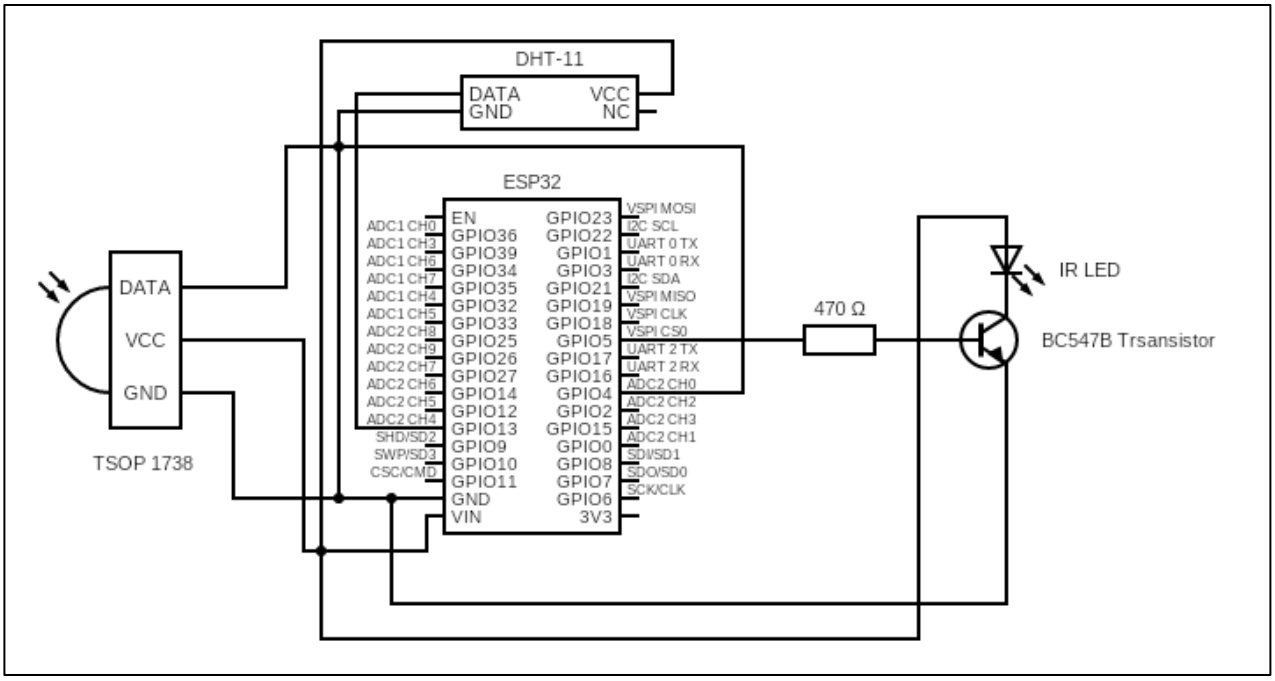

Figure 2: Circuit Diagram of AC Remote Control using Node MCU

3.4 Objective:

The objective of the IoT-based AC remote control using NodeMCU is to provide a user-friendly and energy-efficient solution for controlling the AC unit. The project aims to incorporate temperature and humidity sensors, such as DHT11, to monitor the room's conditions and adjust the AC's temperature accordingly. The use of NodeMCU allows for wireless communication between the remote and the AC unit, providing ease of access and convenience for the user. The primary objective is to provide an efficient and reliable solution for AC control while reducing energy consumption and promoting user convenience.

Additionally, the IoT-based AC remote control system can be integrated with a mobile application, enabling users to remotely monitor and control their AC units from anywhere. The project also focuses on data logging and analysis, allowing users to track their energy usage patterns and make informed decisions for optimizing AC settings. The system prioritizes user comfort, energy efficiency, and environmental sustainability.

Chapter 4: Implementation

In this chapter we take a look at the implementation process of the AC Remote Control using Node MCU wherein we first study about the libraries such as opencv & mediapipe and then go on to study how the code works

4.1 Software Implementation:

4.1.1 Arduino IDE:

Arduino IDE is open-source software that provides an integrated development environment for writing, compiling, and uploading code to Arduino boards. It is designed to simplify the process of programming microcontrollers and allows users to create programs using a simple and easy-to-learn programming language based on C/C++. The IDE includes a text editor, a compiler, a debugger, and a serial monitor, making it easy to write and test code for Arduino boards. It also provides a large library of pre-built code, called "sketches," which can be easily modified and adapted to suit specific needs. The Arduino IDE is compatible with various operating systems and supports a wide range of Arduino boards and other microcontrollers.

4.1.2 Code Implementation:

We used an Arduino sketch for an ESP32 microcontroller board that receives infrared (IR) signals using an IR receiver module and sends IR signals using an IR LED. The received IR signal codes are then displayed on a Blynk mobile app and temperature and humidity data from a DHT11 sensor are also sent to the app.

The code begins by defining several constants such as the Blynk template ID, name, and authentication token. The required libraries are then included for WiFi, Blynk, IRremoteESP8266, IRrecv, IRsend, and DHT11.

Next, several variables and objects are declared for the IR receiver, and IR sender, and decode results. An array of hexadecimal codes is also defined to represent the IR signals that can be sent.

The WiFi network name and password are then defined and the ESP32 board is set up to connect to the WiFi network. The IR receiver is initialized to start receiving IR signals, and the IR sender is also initialized.

The main loop of the sketch first runs the Blynk library, which allows the ESP32 to communicate with the Blynk mobile app. If an IR signal is received, the signal is printed in hexadecimal format and the DHT11 sensor is used to read the temperature and humidity values. These values are then sent to the Blynk app.

The sketch also includes several Blynk virtual write functions that are called whenever a button is pressed on the mobile app. These functions use the IR sender to send the corresponding IR signal based on the button pressed.

4.2 Hardware Implementation:

The code implements an Internet of Things (IoT) project using an ESP32 microcontroller board. The board is connected to an infrared (IR) receiver and IR LED, which are used to receive and send IR signals, respectively.

The IR receiver is connected to pin 33 of the ESP32, while the IR LED is connected to pin 14. The board is also connected to a DHT11 temperature and humidity sensor, which is connected to pin 13. Additionally, the board has an onboard LED, which is connected to pin 2.

The ESP32 board is connected to a WiFi network using the credentials provided in the code. The board communicates with the Blynk cloud platform using an authorization token. The Blynk platform provides a mobile app that can be used to control the board and display sensor data.

The code uses Blynk's virtual pins to receive commands from the mobile app and send sensor data to the app. When a button on the app is pressed, the board sends an IR signal using the IR LED. The board also reads temperature and humidity data from the DHT11 sensor and sends the data to the Blynk app using virtual pins. The onboard LED is used to indicate the status of the board during operation.

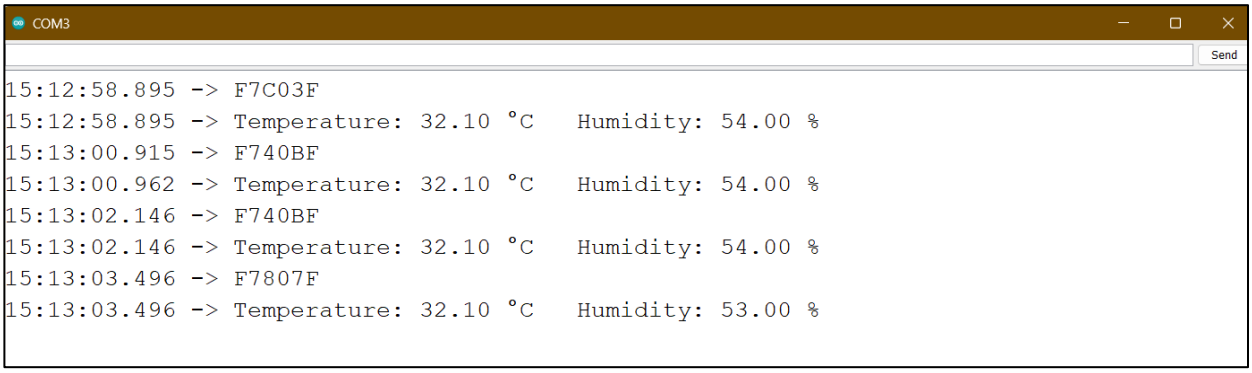

Figure 3: Verifying Hardware Implementation in Arduino IDE

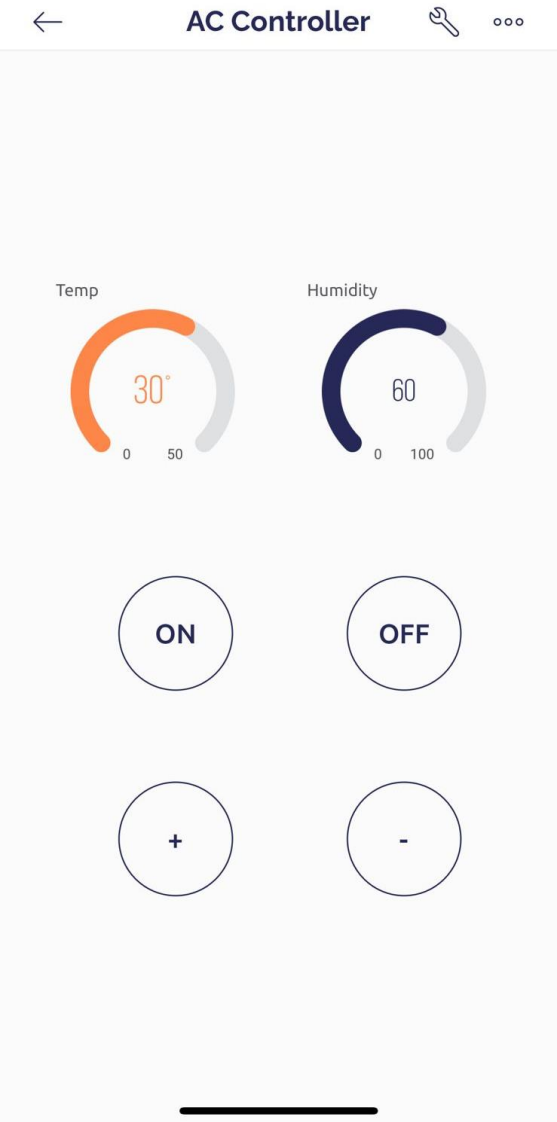

Figure 4: Blynk Application Interface

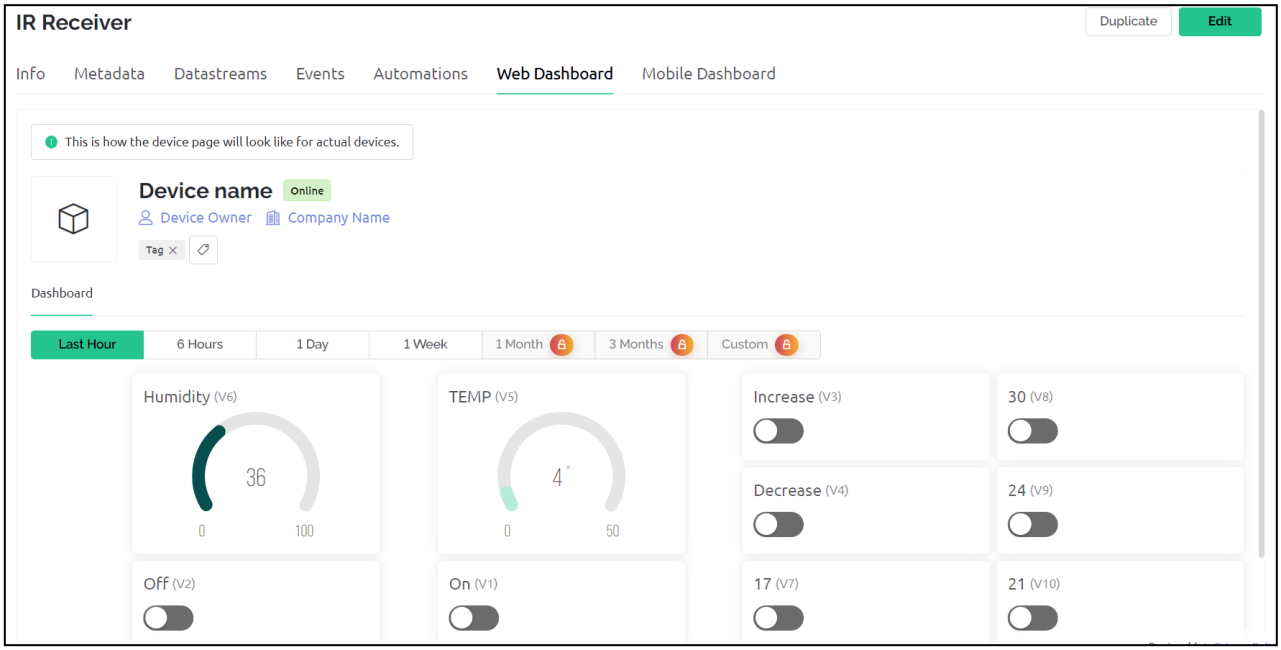

Figure 5: Blynk Web Interface

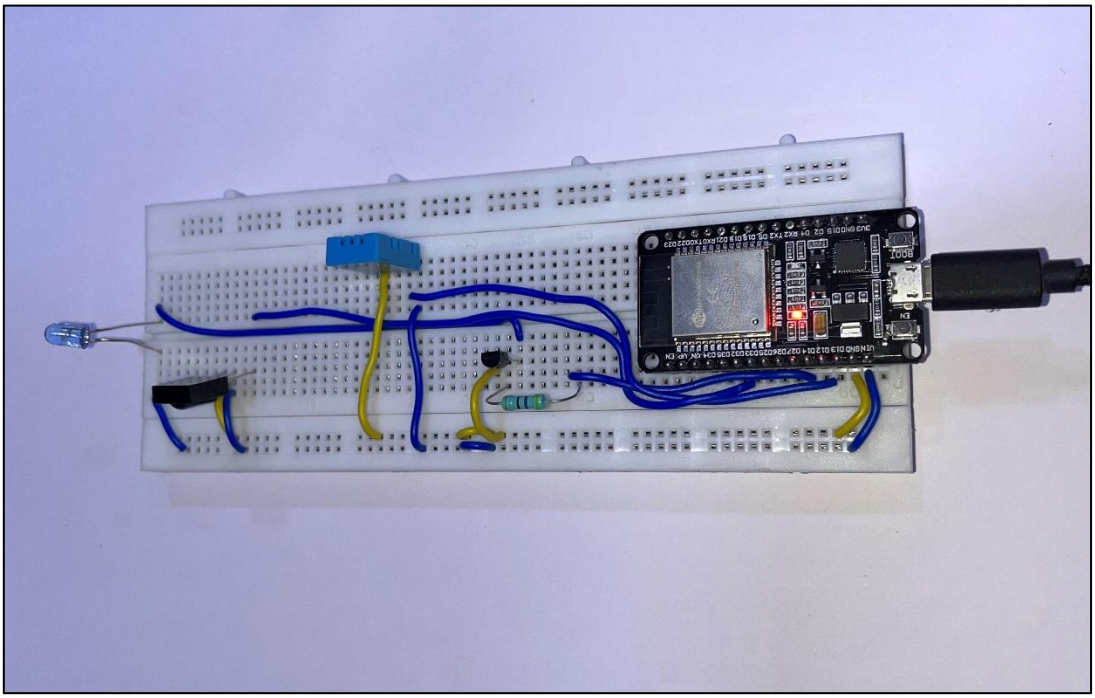

Figure 6: Hardware implementation

Chapter 5: Conclusion & Future Scope

Conclusion:

In conclusion, the IoT-based AC remote control using Node MCU is a practical and efficient solution for controlling air conditioning units remotely. The system utilizes a Node MCU board, IR LED, and TSOP 1738 to transmit and receive signals. The DHT11 sensor is used to monitor the temperature and humidity levels of the room. The project also includes a user-friendly web interface that allows users to turn the AC on/off, increase or decrease the temperature, and view the current temperature and humidity levels.

Through this project, we have achieved our objective of developing a low-cost, efficient, and user-friendly AC remote control system. The system has the potential to save energy and reduce costs by allowing users to remotely control their air conditioning units.

We have also identified some limitations of the system. The lack of automatic scheduling is a significant drawback as users will need to manually adjust the temperature as per their needs. Additionally, the DHT11 sensor may not be very accurate, which can impact the overall efficiency of the system.

Overall, the IoT-based AC remote control using Node MCU is a promising project that has the potential to make a significant impact in the field of home automation. With some improvements and modifications, this system can be further developed to offer more advanced features and capabilities.

Future Scope:

The future scope of an IoT-based AC remote control using NodeMCU is vast. Some potential improvements that could be made to the system include:

1] Integration with voice assistants: The AC remote control system could be integrated with popular voice assistants like Amazon Alexa or Google Assistant. This would allow users to control their AC using voice commands.

2] Smart scheduling: Adding a scheduling feature to the system would allow users to set their AC to turn on or off automatically at specific times of the day. This would improve energy efficiency and reduce user effort.

3] Remote access: The system could be improved to allow remote access to the AC control, meaning users could control their AC from anywhere in the world using a mobile app.

4] Integration with other home automation systems: The system could be integrated with other home automation systems, such as lighting or security systems, to create a complete smart home experience.

5] Advanced sensors: The system could be improved by using advanced sensors to monitor factors such as air quality or occupancy. This would allow for more intelligent and personalized control of the AC.

Overall, the future scope of IoT-based AC remote control systems is exciting, and there is a lot of potential for further development and improvement. As technology advances and more devices become interconnected, the possibilities for smart home automation are endless

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