FAN SPEED CONTROL USING REMOTE AND ANDROID

A Project report is submitted in partial fulfillment of the requirements for the award of Degree of Bachelor of Science in Electrical and Electronic Engineering.

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FEBRUARY, 2024

DECLARATION

I hereby declare that this project "**Fan Speed Control Using Remote And Android**" represents my own work which has been done in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering, and has not been previously included in a thesis or dissertation submitted to this or any other institution for a degree, diploma or other qualifications. I have attempted to identify all the risks related to this research that may arise in conducting this research, obtained the relevant ethical and/or safety approval (where applicable), and acknowledged my obligations and the rights of the participants.

Signature of the candidates

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APPROVAL

The project entitled **“Fan Speed Control Using Remote And Android”** submitted by **Md Najmul Islam (192-33-5244)** has been done under my supervision and accepted as satisfactory in partial fulfillment of the requirements for the degree of **Bachelor of Science in Electrical and Electronic Engineering** in **February, 2024.**

Signed

Sutapa Debnath
04.02.2024

Ms. Sutapa Debnath
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Dedicated

To

I dedicate this project to my parents and my brothers. I hope that this assignment will complete the dream that you had for me all this many years ago when you choose to give me the best education you could.

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LIST OF ABBREVIATIONS

BAETE	Board of Accreditation for Engineering and Technical Education
PWM	Pulse width modulation

LIST OF SYMBOLS

Symbol	*Name of the symbol*
ω	Angular velocity, rad/sec
ξ	Damping ratio

ACKNOWLEDGEMENT

First of all, I want to give thanks to **Almighty Allah**. With his blessing I are able to complete our work with best effort.

I want to pay our utmost respect to our Supervisor **Ms. Sutapa Debnath, Senior Lecturer** of the **Department of EEE, Daffodil International University** for who has given us the chance to work on an impactful idea and taken care of every issue of development of this concept. Then I would like to take this opportunity to express gratitude to our supervisor for being dedicated in supporting, motivating and guiding us throughout this project. This project can't be done without his useful advice and help. Also thank him very much for giving us the opportunity to work with this project.

ABSTRACT

The project focuses on creating a sophisticated system to regulate the speed of an AC fan utilizing both an infrared (IR) remote control and Bluetooth technology. The primary goal is to enable users to adjust the fan's speed remotely and effortlessly through two distinct methods. The system integration involves a series of hardware components, including an IR receiver module, Bluetooth module, microcontroller, motor driver, and the AC fan unit. For IR remote control functionality, the microcontroller is programmed to interpret and decode signals transmitted by the IR remote. Specific commands from the remote control are linked to various speed settings of the AC fan. Users can manipulate the fan speed, increasing or decreasing it based on the signals received by the microcontroller. The motor driver acts upon these commands, adjusting the fan's speed accordingly. Simultaneously, Bluetooth integration enables remote control through wireless communication between the microcontroller and a Bluetooth-enabled device, such as a smartphone or tablet. These commands are received by the microcontroller via Bluetooth, enabling an alternate method for fan speed adjustment.

Keywords: fan speed control, Bluetooth control, IR control

CHAPTER 1
INTRODUCTION

1.1 Introduction

The demand for smart and convenient solutions for everyday appliances has surged in today's technology-driven era. Among these, the ability to remotely control household devices like AC fans has gained significant interest. The project at hand delves into creating a sophisticated system that allows users to adjust AC fan speeds remotely using two widely accessible technologies: infrared (IR) remote control and Bluetooth. The primary objective of this project is to design an efficient and user-friendly system capable of seamlessly regulating the speed of an AC fan through two distinct remote-control methods. Integrating IR remote and Bluetooth technologies provides users with versatile options for fan speed adjustment, catering to varying user preferences and scenarios. This project holds substantial significance in enhancing user convenience and offering flexible control options for AC fan operation. By harnessing the capabilities of IR remote control and Bluetooth technology, users can modify fan speeds from a distance, eliminating the need for manual adjustments and providing a level of comfort and adaptability suited to modern lifestyles.

The project involves amalgamating hardware components such as IR receivers, Bluetooth modules, microcontrollers, motor drivers, and AC fans. These components are intricately connected and programmed to facilitate communication and control. Through IR remote control, users can send specific commands to the system, allowing precise adjustments to the AC fan's speed. Simultaneously, Bluetooth integration enables wireless control from a smartphone or similar device, expanding the control capabilities and enhancing the system's versatility. The project will follow a structured approach encompassing hardware setup, software development, integration of communication protocols, user interface design, rigorous testing, and refinement stages. The convergence of hardware and software elements aims to deliver a robust system that seamlessly responds to user commands, ensuring accurate and efficient control over the AC fan speed.

1.2 Problem Statement

The conventional operation of AC fans presents a significant challenge due to the absence of remote-control features, necessitating manual adjustments that hinder convenience and adaptability. Users face limitations in tailoring fan speeds to specific needs, especially in situations where remote accessibility is crucial. The lack of remote-control options restricts users to fixed-speed settings, undermining flexibility and convenience in modern living environments. This gap between traditional fan control methods and the demands for remotely accessible appliances highlights the pressing need for a solution. The problem statement revolves around addressing these limitations by leveraging both IR remote and Bluetooth technologies to empower users with versatile and convenient means to regulate AC fan speeds remotely, ensuring adaptability to changing preferences and environments while enhancing overall user experience and comfort.

1.3 Objectives

The objectives of a Fan Speed Control Based IR Remote and Bluetooth are multifaceted, aiming to address specific needs and challenges while leveraging technological advancements. Here are several key objectives such as:

- To control AC fan speeds conveniently from a distance, eliminating the need for physical proximity or manual adjustments.
- To Integrate both IR remote and Bluetooth technologies to offer multiple ways for users to adjust fan speeds, catering to diverse preferences and accessibility options.
- To Provide a user-friendly and intuitive interface for seamless fan speed adjustments, ensuring ease of use for individuals with varying technical abilities.
- To Align the AC fan control system with contemporary living standards by incorporating smart technologies, facilitating remote accessibility and enhancing comfort.
- To Develop a reliable and robust system that ensures accurate and efficient control over fan speeds, emphasizing stability and consistent performance.

1.4 Methodology

The methodology for developing a Fan Speed Control Based IR Remote and Bluetooth involves a structured approach encompassing several key stages. Here's some outline of the methodology:

- Find project goals, functionalities, and user requirements for remote control of AC fan speed through IR and Bluetooth technologies.
- Select appropriate IR receiver modules, Bluetooth modules, microcontrollers, motor drivers, and the AC fan.
- Program the microcontroller to decode signals received from the IR remote.
- Assign specific commands from the remote to correlate with different fan speed levels.
- Implement logic to interpret these commands and adjust the fan speed using the motor driver.
- Develop communication protocols for Bluetooth interaction between the microcontroller and a Bluetooth-enabled device.
- send commands and interpret them to adjust fan speed via Bluetooth communication.
- Conduct rigorous testing to validate the functionality of both IR remote and Bluetooth control.
- Debug and refine the code to rectify any issues or inconsistencies in fan speed control.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

The integration of remote-control functionalities in household appliances has marked a significant leap in enhancing user convenience and adaptability within living spaces. In this context, the regulation of AC fan speeds through the amalgamation of infrared (IR) remote and Bluetooth technologies stand as a promising venture. This literature review aims to delve into existing research, studies, and publications surrounding the utilization of IR remote and Bluetooth control mechanisms specifically directed towards managing the speed of AC fans.

2.2 Related Research

Numerous applications have been developed and implemented for smart fans or comparable items' control systems. The development of the smart system makes use of circuits and sensors. Typically, microcontrollers, temperature sensors, and sensors for human sensing are employed. In this part, a concise overview of relevant literature is provided. According to Basil Hamed, smart house technology is one application of a certain combination of technologies that realizes the principles of home automation. This house has an extremely sophisticated automated system in place for appliances, security, lighting, and temperature management, among many other things. When directly connected to a DAQ, an LM35 temperature sensor is utilized to regulate the temperature [1]. Resistance was employed by certain researchers. For industrial or residential automation, temperature detectors (RTDs) serve as the temperature controller [2]–[5]. To enhance stationary subject recognition, a pricey sensor called the Doppler radar occupancy sensor that uses respiratory and cardiac signals is developed. The data from this post-processing sensor may identify various activity levels [6]. While ultrasonic and passive infrared (PIR) sensors are frequently utilized as occupancy sensors, they are not very expensive. These sensors' shortcoming is that they may produce false alarms. But a microcontroller can be used to get around it. [7]–[8].

2.3 Compare and Contrast

IR remote and Bluetooth technologies serve as popular means for controlling AC fan speeds, each offering distinct advantages and limitations in their functionalities and implementations. IR remote control operates on infrared signals, commonly used in various household appliances, including AC fans. It facilitates straightforward communication between the remote control and the fan unit, allowing users to adjust fan speeds within line-of-sight proximity. However, its limitations arise from this line-of-sight requirement, as obstacles can disrupt signals, necessitating direct positioning towards the fan for effective control. Conversely, Bluetooth technology presents a wireless and versatile control mechanism, enabling users to adjust fan speeds from a distance, even through walls or obstacles within the operational range. Bluetooth offers a broader range of control, making it suitable for scenarios where direct line-of-sight access isn't feasible. Moreover, Bluetooth technology allows multiple devices to connect to the fan system simultaneously, enhancing flexibility in controlling the fan from different sources. However, Bluetooth's wider signal range might result in interference issues or security concerns if not appropriately secured.

In contrast, while IR remote control is straightforward and reliable within its range, it's limited by line-of-sight constraints, making it less versatile for long-range control or situations with obstructed paths. Bluetooth overcomes this limitation, offering broader coverage and multi-device connectivity, but it might face interference challenges or require additional security measures. Both technologies provide efficient means for remote fan control, yet their distinct operational scopes and limitations cater to different user preferences and environmental settings. Selecting between IR remote and Bluetooth control for AC fan speed depends on factors such as range requirements, environmental conditions, and the level of control flexibility desired by the user.

2.4 Summary

In summary, the literature review on IR remote and Bluetooth control for AC fan speed explores the existing research, studies, and technological implementations related to remote control systems in the context of fan speed regulation.

CHAPTER 3
PROJECT DESIGN

3.1 Introduction

The implementation of IR remote and Bluetooth control mechanisms for regulating AC fan speed necessitates a structured approach encompassing the selection of components, hardware setup, software development, and integration of communication protocols. This section outlines the materials utilized and the methodologies employed in developing the IR remote and Bluetooth-controlled AC fan speed system.

3.2 Methods and Materials

Methods

- The hardware components chosen play a pivotal role in the system's functionality. Selection criteria involve opting for suitable IR receiver modules, Bluetooth modules, microcontrollers, motor drivers, and the AC fan unit.
- The setup of the hardware components involves the intricate wiring and configuration of the selected modules and devices. This section details the assembly process, wiring diagrams, and connections established among the IR receiver, Bluetooth module, microcontroller, motor driver, and the AC fan unit.
- The development of software protocols and codes for efficient communication and control is fundamental. This section elaborates on the programming languages utilized, software tools employed, and the coding methodologies adopted to program the microcontroller.

Materials

- **Main Microcontroller** use for read data and control fan.
- **Bluetooth Module** use for read fan speed control data from app
- **IR transmitter** use for send IR data
- **IR decoder** read IR data and send to main controller
- **AC Fan driver module** control fan speed based main controller signal.

Flowchart

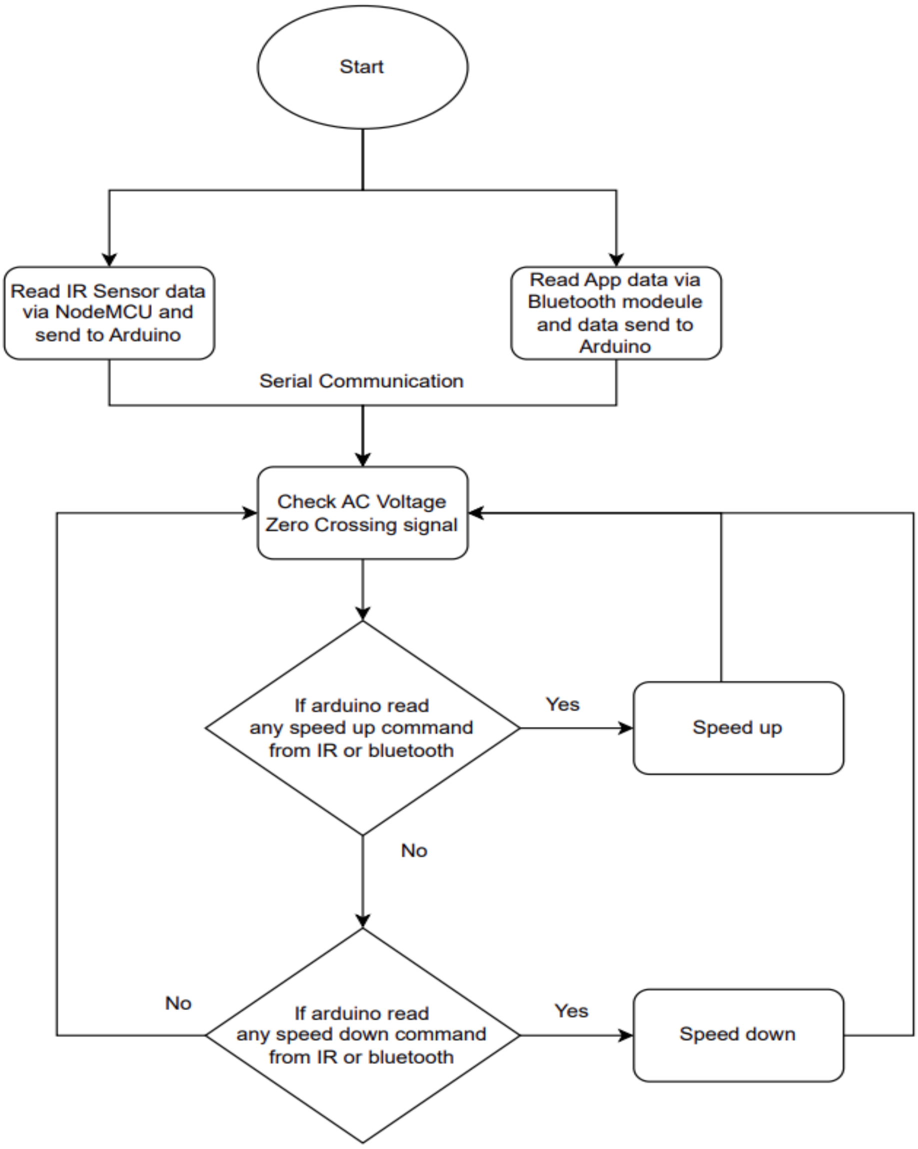


Fig 3.1 Flowchart

In this flowchart IR data read using NodeMCU and send to Arduino uno other hand Bluetooth module read data from smart phone and send to Arduino. AC voltage zero crossing check using zero crossing module. If Arduino read fan speed up command from Bluetooth or IR remote then fan speed increases. When Arduino read fan speed down command from Bluetooth or IR remote then fan speed decreases.

System Design

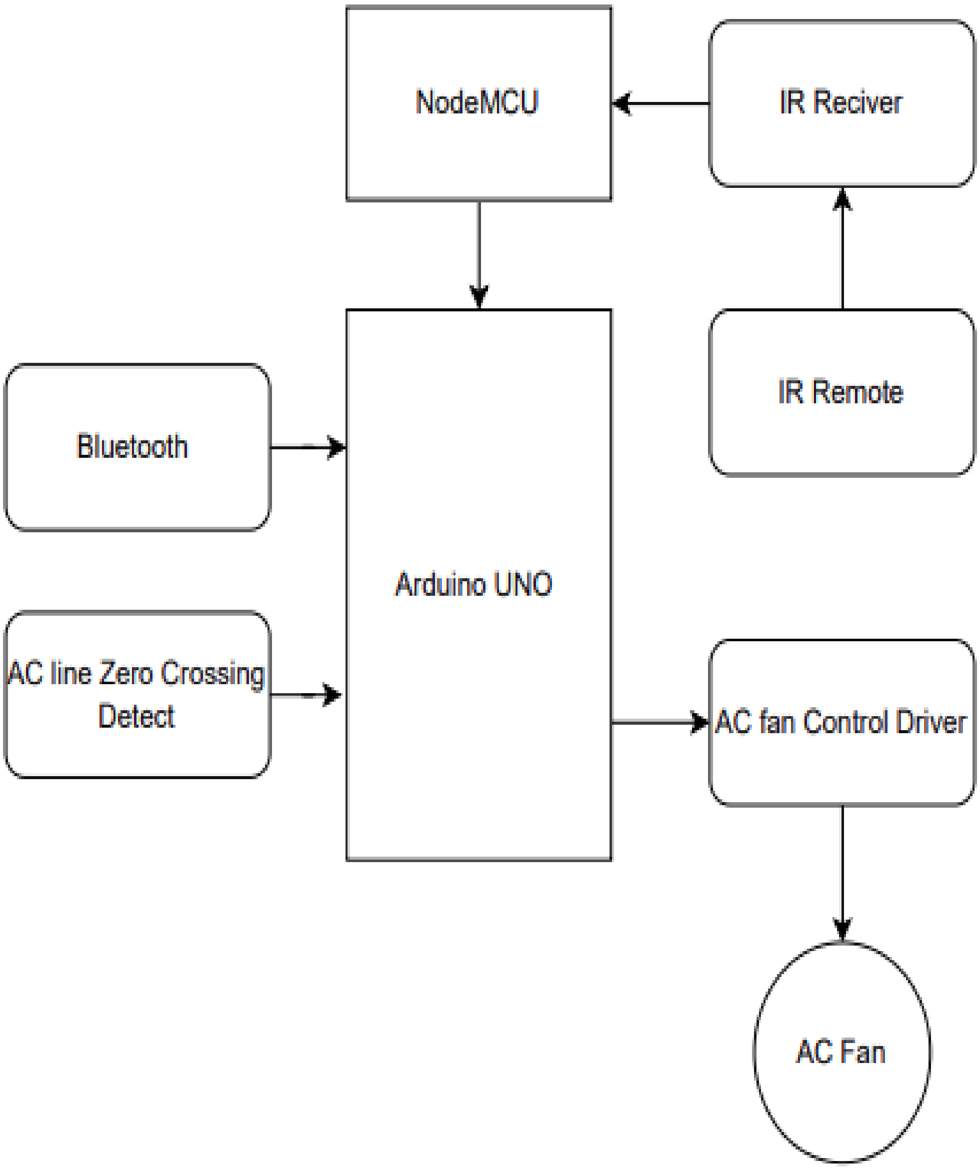


Fig 3.2 Block Diagram of this project

Here in block diagram Bluetooth module, zero crossing detect, and IR data read Arduino UNO then send fan control signal to AC fan control driver.

Components

- Arduino UNO

  A pioneer in the field of microcontroller boards, the Arduino UNO is well-known for its availability, adaptability, and intuitive design. The ATmega328P microcontroller, which powers it, is at its core. It provides a variety of digital and analog I/O pins, USB connectivity for convenient programming and power supply, and an inviting environment via the Arduino IDE (Integrated Development Environment). With the help of this open-source platform, experts, learners, and enthusiasts can explore the fields of electronics, programming, and prototyping with ease. The Arduino UNO is a versatile platform that can be expanded with different shields to add features such as wireless communication and sensor integration. This allows the Arduino to be used for a wide range of projects and creates a lively community of innovators, enthusiasts, and learners. Its versatility and ease of use have made it an indispensable resource for research, experimentation, and creativity in the fields of DIY electronics and embedded systems.

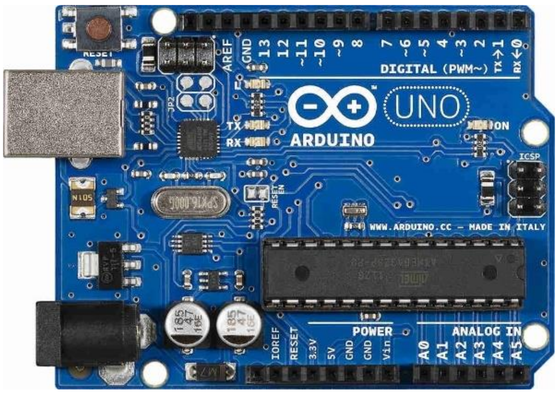


Fig 3.3 Arduino UNO

- **HC-05 Bluetooth Module:**

  Smooth Bluetooth connectivity can be achieved in a variety of electronic applications with the help of the HC-05 Bluetooth module, a flexible and popular wireless communication module. It provides an affordable option for wireless data transmission because to its Serial Port Protocol (SPP) profile, which makes serial communication between devices clear and easy. In projects like remote-control systems, Internet of Things applications, and data transmission between devices, the HC-05 acts as a dependable bridge to enable

Bluetooth capabilities because of its simplicity of integration and compatibility with many microcontrollers, including Arduino boards. Because of its flexibility, ease of programming via AT commands, and support for both master and slave modes, the HC-05 is a popular option for makers, hobbyists, and professionals looking to easily integrate Bluetooth connectivity into their electronic creations.

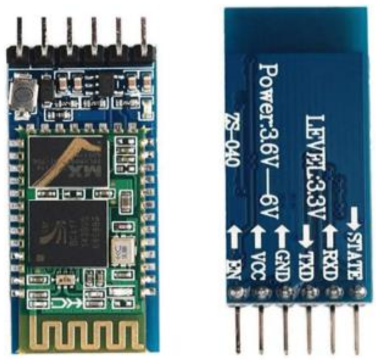


Fig 3.4 HC-05 Bluetooth Module

- **AC light dimmer:**

  AC light dimmers serve as indispensable devices in modern lighting and fan systems, offering dynamic control over the brightness levels and fan speed of AC-powered light sources and fans. These dimmers function by modulating the voltage and power delivered to the light fixture, providing users with the flexibility to adjust illumination from dazzling brilliance to subdued ambiance. Employing methodologies like phase-cut dimming or pulse-width modulation (PWM), they manipulate the AC waveform to regulate light intensity. Phase-cut dimming, a conventional technique, involves altering the phase angle of the AC waveform, reducing the power flow to the light or fan and consequently dimming it. Conversely, PWM rapidly toggles power delivery on and off, effectively adjusting the average power supplied to the light source and thereby controlling brightness.

  Versatility defines AC light dimmers, available in diverse forms ranging from classic rotary or slide wall-mounted dimmer switches to advanced digital or smart dimmers compatible with home automation systems. These devices offer more than mere control; they empower users to set the ambiance, conserve energy, and extend bulb lifespan by reducing intensity. However, while selecting an AC light dimmer, it's crucial to consider compatibility with different bulb types. Some dimmers might be optimized for specific bulbs and fans, while others are more versatile. Furthermore, ensuring compatibility helps prevent issues like flickering, buzzing, or reduced dimming range, guaranteeing optimal performance and longevity for both the dimmer and the light source.

The applications of AC light dimmers extend across various settings, including homes, commercial spaces, theaters, and hospitality venues. They facilitate mood setting, complementing tasks or activities, and optimizing energy usage. The evolving technology in smart dimmers integrates seamlessly with home automation systems, allowing remote control and scheduling, further enhancing convenience and energy efficiency. As lighting continues to be a focal point in enhancing environments, AC light dimmers remain pivotal in delivering not just adjustable illumination and speed but also contributing to energy conservation and customized lighting and fan speed experiences.

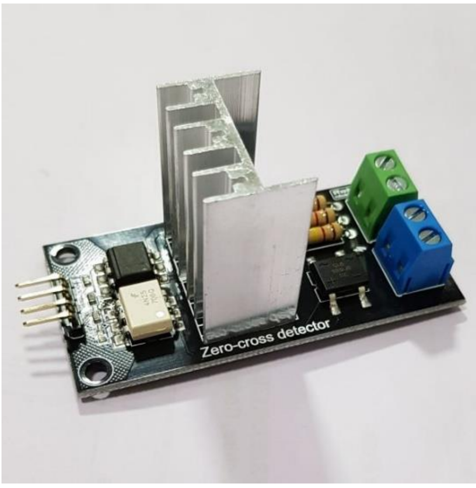


Fig 3.5 AC light dimmer

- **NodeMCU:**

NodeMCU is a versatile open-source development board based on the ESP8266 Wi-Fi module, renowned for its seamless integration with the Internet of Things (IoT) projects. It combines the ESP8266 module with a Lua-based firmware, providing a simple and efficient platform for developing IoT applications. Its compact size and built-in Wi-Fi capabilities enable easy connectivity to wireless networks, making it an ideal choice for IoT prototyping and projects requiring remote data transmission or control. NodeMCU's GPIO pins allow interaction with various sensors, actuators, and peripherals, facilitating the creation of diverse IoT applications. Furthermore, its compatibility with the Arduino IDE simplifies programming for those familiar with Arduino, enabling a broader community of developers to leverage its capabilities. NodeMCU's affordability, flexibility, and user-friendly development environment have made it a popular choice among hobbyists, makers, and professionals alike for realizing innovative IoT solutions and smart devices.

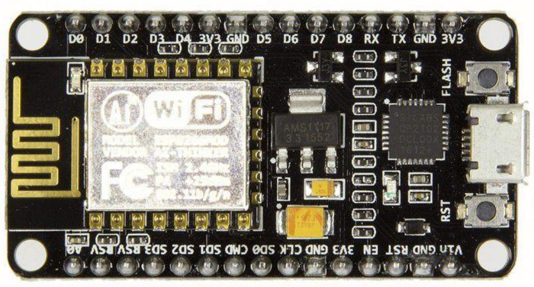


Fig 3.6 NodeMCU

- **IR (Infrared) Receiver:**

  The IR (Infrared) Receiver is a widely used, precise, and sensitive component designed to receive infrared signals emitted by remote controls. Operating within a specific frequency range of typically 38 kHz, this receiver module efficiently detects and demodulates IR signals transmitted by remote controls, converting them into electrical signals for decoding and subsequent command execution. With its integrated photo detector, preamplifier, and internal filter, the IR Receiver effectively screens out ambient noise and interference while focusing solely on the desired IR signals. Its standardized pin configuration and compatibility with various microcontrollers simplify integration into circuit designs, making it a popular choice for numerous IR remote control applications in consumer electronics, automation systems, and robotics. This receiver's reliability, accuracy in signal detection, and ease of implementation make it an essential component for projects requiring precise IR signal reception and interpretation, enabling seamless remote control functionality in a myriad of electronic devices and applications.

Fig 3.7 IR Receiver

3.3 Design Specifications. Standards and Constraints

Here in this section, I present our system circuit diagram. Show in Fig. 3.8

Here the Arduino UNO is used as the primary control device in this setup. According to this circuit design, the Bluetooth module connects the Arduino UNO's pins 7 and 8 for serial communication with the HC-05 TX and RX, respectively. AC Zero crossing is linked to Arduino interrupt pin 2 on the other side of the motor driver connect module connection to Arduino PWM (pulse width modulation) pin 5. An IR receiver is connected to NodeMCU. NodeMCU decodes data from an infrared receiver, sends it to an Arduino UNO, and controls the fan speed.

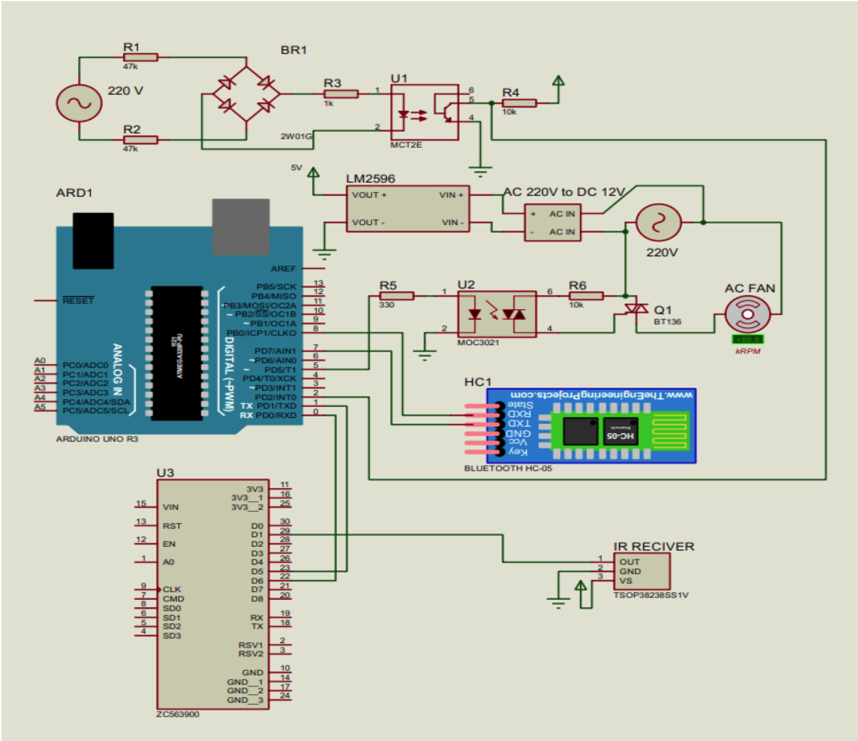


Fig. 3.8 Circuit diagram of this project

3.4 System Analysis

Here in this section discourse about system analysis.

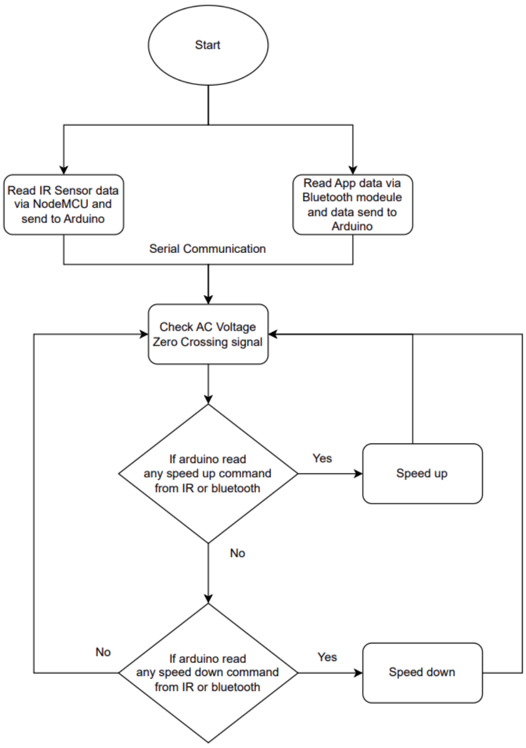


Fig. 3.9 Flowchart of this project

3.5 Simulation

Simulating the control of AC fan speed through an IR remote and Bluetooth involves emulating the interactions between virtual representations of hardware components and their functionalities. Utilizing simulation software equipped with microcontroller support, one can mimic the behavior of the IR receiver, Bluetooth module, microcontroller, motor driver, and AC fan unit. By configuring these virtual components to mirror their real-world counterparts' connections and behaviors, the simulation replicates the communication protocols between the IR remote or Bluetooth-enabled device and the control system. Simulated signals, resembling IR commands and Bluetooth transmissions, are generated to emulate user inputs. The simulation evaluates how the microcontroller interprets these signals, processes the control logic, and adjusts the motor driver's output to simulate varying fan speeds. While simulations offer a controlled environment for testing and refining the control system's logic, they serve as a preliminary step before hardware implementation, providing insights into system behavior and enabling optimization before physical realization.

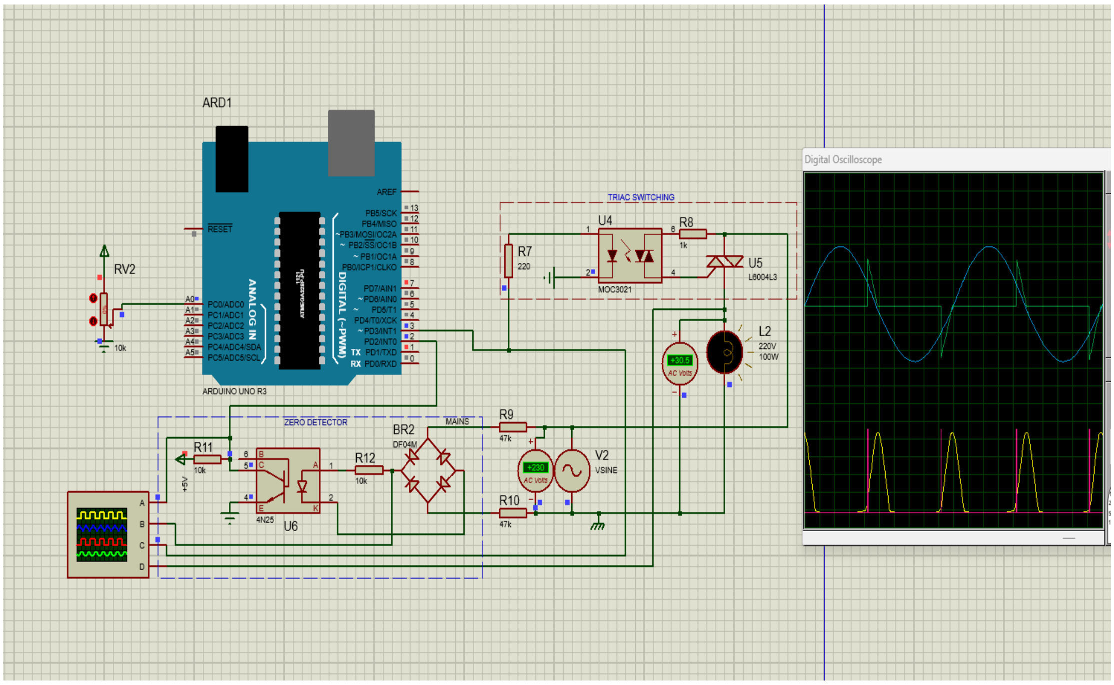


Fig. 3.10 System simulation

Here not possible to simulate IR sensor and Bluetooth Module. That why use Potentiometer and get the result. In the simulation I saw Some output result in graph like Input Signal that full sine wave, PWM signal, zero crossing signal and Output signal.

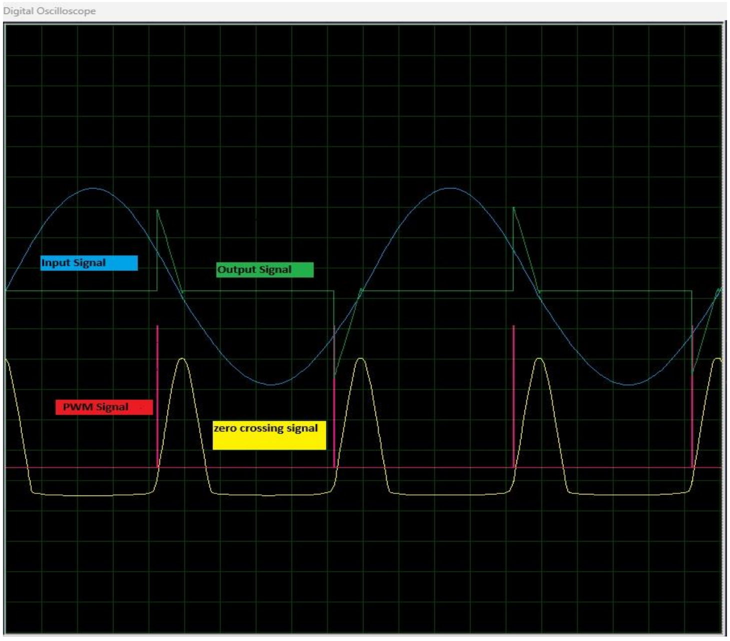


Fig. 3.11 Simulation Output graph

Here zero crossing signal high when AC sine wave come to zero. That signal help to controller output signal. Also, PWM control output. When saw on output signal I see, output signal some time high and maximum time goes to off. That mean output voltage will very low show on fig. 3.11.

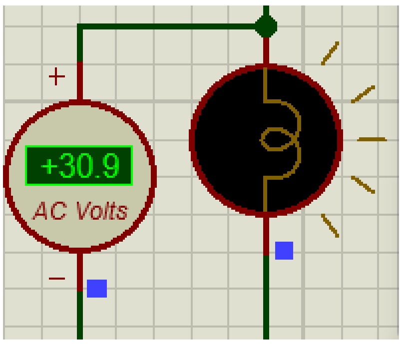


Fig. 3.12 Output low voltage.

When PWM signal goes high then output webform gape will reduce. And voltage will high.

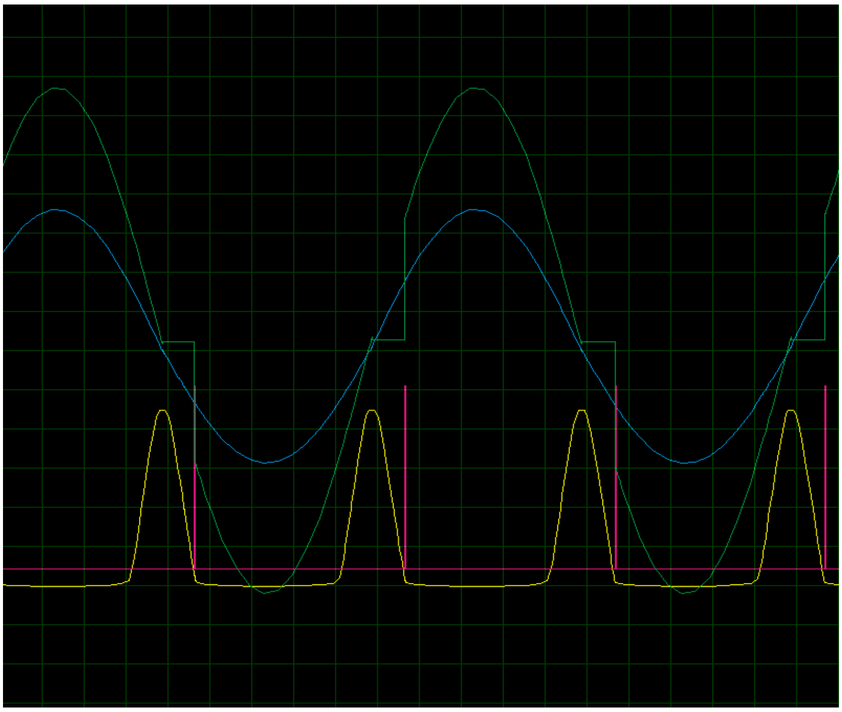


Fig. 3.13 Simulation Output graph high output

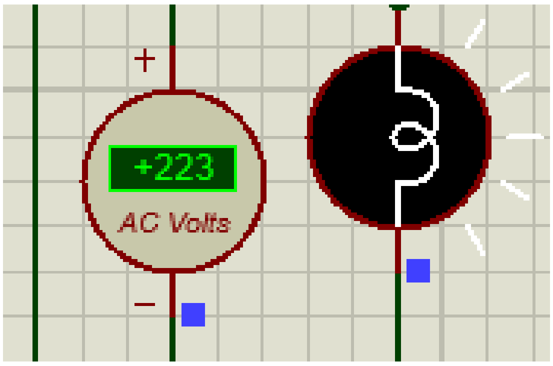


Fig. 3.14 Output High voltage.

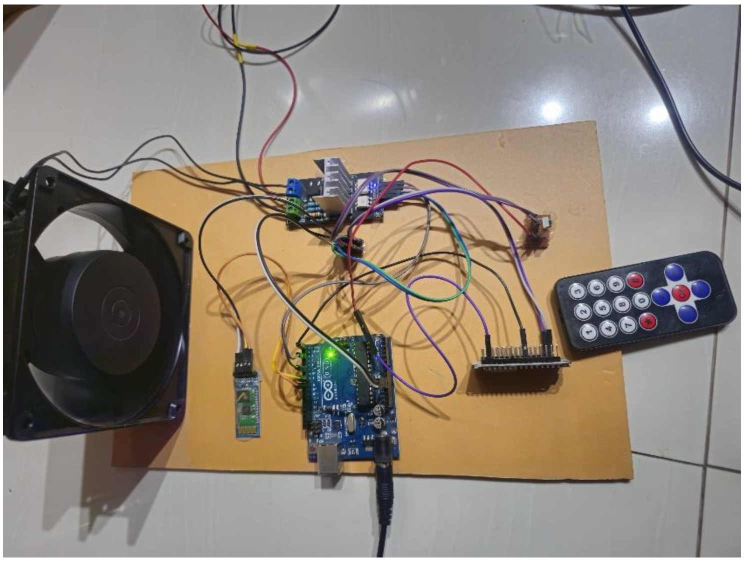


Fig. 3.15 Fan run based on remote control.

3.6 Summary

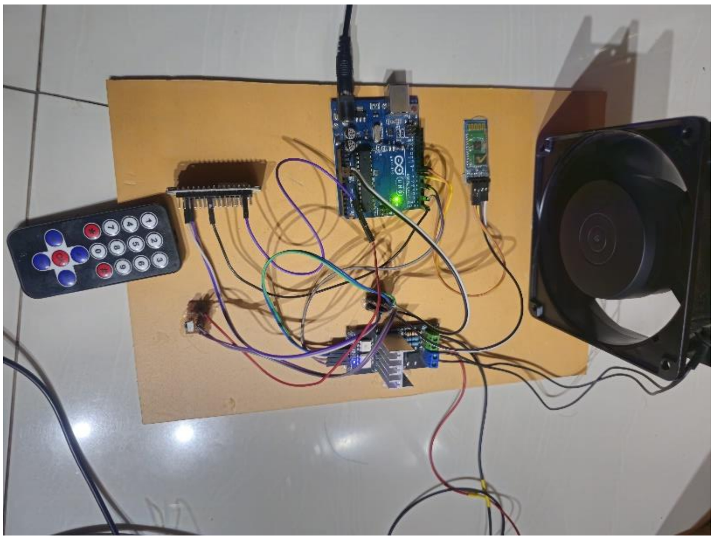
The materials and methods section for implementing IR remote and Bluetooth control for AC fan speed encompasses a structured approach to detailing the components used and the methodologies applied in creating the control system. It systematically outlines the selection criteria for hardware components such as the IR receiver module, Bluetooth module, microcontroller, motor driver, and AC fan unit, emphasizing compatibility and functionality. The section further delves into the hardware setup, elucidating the assembly process, circuitry design, and connections established among the components. In the software development phase, it delineates the programming languages, tools, and algorithms employed to program the microcontroller, enabling interpretation of signals from both IR and Bluetooth sources for fan speed control. The section culminates in testing methodologies, including functionality tests and signal reception tests, ensuring the system's accuracy, responsiveness, and reliability. Overall, this comprehensive section serves as a blueprint for researchers or practitioners to understand the systematic integration of components and software protocols, guiding the successful implementation of IR remote and Bluetooth control for regulating AC fan speed.

CHAPTER 4
RESULTS AND DISCUSSIONS

4.1 Results

The implementation of IR remote and Bluetooth control for AC fan speed yields transformative results, notably enhancing user comfort, accessibility, and energy efficiency. This technology empowers users to remotely adjust fan speeds through familiar IR remotes or Bluetooth-enabled devices like smartphones or tablets. This personalized control allows individuals to fine-tune fan speeds to match their immediate comfort requirements. Moreover, it fosters a more accessible environment, accommodating individuals with mobility limitations or diverse needs by enabling remote control accessibility. Energy efficiency stands as a significant outcome, as users can precisely regulate fan speeds, optimizing energy consumption based on real-time preferences. However, the successful integration of these control methods hinges on resolving challenges related to signal interference, and security protocols, and ensuring compatibility across devices. Addressing these challenges is pivotal to maximizing the benefits and further advancing the efficacy of IR remote and Bluetooth-controlled AC fan speed systems in homes and commercial settings.

Fig. 4.1 Full Project picture.



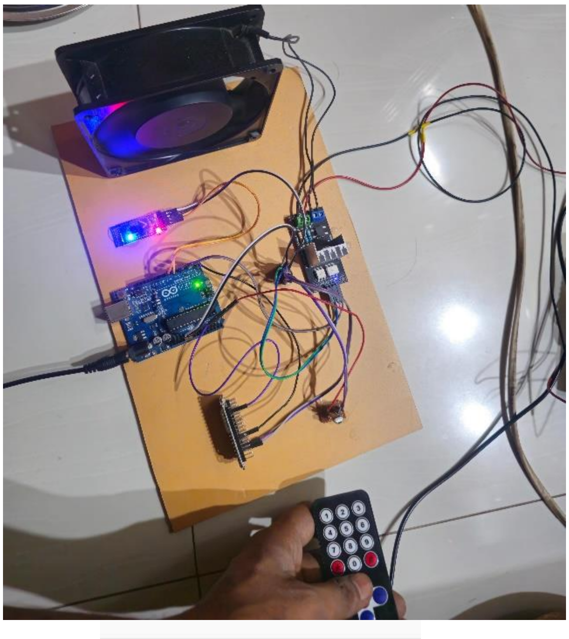


Fig. 4.2 Control Fan using Remote.

Fig. 4.2 Connect App with Bluetooth module.

Fig. 4.3 Send fan speed up and down command using using app.

4.2 Discussions

Discussions around IR remote and Bluetooth control for AC fan speed revolve around its transformative impact on user comfort, convenience, and energy efficiency. These technologies offer personalized control over fan speeds, enhancing comfort by allowing adjustments to suit individual preferences. The accessibility provided, especially through smartphone integration via Bluetooth, widens the user base, catering to diverse needs and accessibility requirements. However, discussions also highlight technical challenges, such as signal interference, command conflicts, and security considerations. Resolving these issues becomes crucial for seamless operation and wider adoption. Moreover, conversations often delve into the broader context of smart home integration, emphasizing the role of these technologies within the larger ecosystem of interconnected devices and the potential for future innovations. The discussions encompass balancing user-centric benefits with technical challenges and the ongoing evolution of these control mechanisms in the realm of home automation and energy conservation.

CHAPTER 5
PROJECT MANAGEMENT

5.1 Task, Schedule and Milestones

All things together there were very few resources. This project had to be completed by combining parts from various sources. It is the superior know-how of C++ and Python that has helped the most in its creation.

Research and Analysis (Week 1-4)
Task: Research Bluetooth and IR remote communication with Arduino
Schedule: 4 weeks
Milestone: Completion of research and analysis report

Design and Development (Week 5-8)
Task: Design the System platform and develop the platform architecture
Schedule: 4 weeks
Milestone: Completion of the design and development of the platform

Deployment and Testing (Week 9-12)
Task: Deploy the platform to a small group of early adopters for additional feedback
Schedule: 4 weeks
Milestone: Completion of the deployment and testing phase

Data Analytics and Visualization (Week 13-16)
Task: Develop data analytics and visualization tools
Schedule: 4 weeks
Milestone: Completion of data analytics and visualization tools

Launch and Maintenance (Week 17-20)
Task: Launch the platform to the public
Schedule: 4 weeks
Milestone: Completion of the launch and maintenance phase.

5.2 Resources and Cost Management

1	Arduino Uno	850
2	Bluetooth Module	400
3	Zero crossing module	900
4	AC Fan	500
5	Wire	100
6	Power supply	400
7	NodeMCU	500
8	IR Receiver and Remote	250
8	Other	500
	Total=	4400 TK

Table 1.1 Cost Management

CHAPTER 6
IMPACT ASSESSMENT OF THE PROJECT

6.1 Economical, Societal and Global Impact

The implementation of IR remote and Bluetooth control for AC fan speed carries multifaceted impacts on the economy, society, and the global landscape. Economically, these technologies offer avenues for energy efficiency, potentially leading to reduced utility costs for consumers and businesses alike. Extended lifespan of AC fan units translates to cost savings through decreased maintenance and replacement expenses. Societally, these control mechanisms bring convenience and comfort by allowing personalized adjustments to suit individual preferences, fostering a more accessible environment, particularly for individuals with mobility challenges. Moreover, they contribute to raising awareness about energy conservation, promoting environmentally conscious behaviors. On a global scale, widespread adoption of such technologies supports energy conservation initiatives, aligning with global efforts to reduce carbon footprints. The integration of IR remote and Bluetooth control for AC fan speed not only enhances user experiences but also contributes significantly to sustainability efforts and technological advancements on a global platform.

6.2 Environmental and Ethical Issues

The implementation of IR remote and Bluetooth control for AC fan speed introduces environmental and ethical considerations. While these technologies offer energy-saving potential, their production and disposal raise environmental concerns, such as electronic waste and resource depletion. Manufacturing processes and materials used in these devices may contribute to environmental degradation if not handled responsibly. Additionally, the reliance on electronic components necessitates proper disposal methods to mitigate e-waste's environmental impact. Ethically, issues may arise concerning data privacy and security with Bluetooth-enabled devices, requiring robust measures to safeguard user information. Moreover, ensuring fair labor practices and responsible sourcing of raw materials becomes pivotal in maintaining ethical standards throughout the supply chain.

CHAPTER 7
CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Implementing IR remote and Bluetooth control for AC fan speed concludes with several key insights and implications. These technologies offer significant advantages in terms of convenience, energy efficiency, and user comfort. The ability to regulate fan speed remotely, whether through IR signals or Bluetooth connectivity, provides users with personalized control over their environments, enhancing comfort and convenience. Moreover, the potential for energy savings through optimized fan speed adjustment aligns with sustainable practices, contributing to reduced electricity consumption and utility costs. However, their implementation requires a focus on addressing environmental concerns related to electronic waste and resource usage, along with ethical considerations concerning data security and fair labor practices. Moving forward, optimizing these technologies involves a commitment to sustainable manufacturing, ethical sourcing, and responsible disposal methods to mitigate their environmental and ethical impacts. Overall, the integration of IR remote and Bluetooth control for AC fan speed underscores the importance of technological innovation in enhancing user experiences while emphasizing the need for ethical and environmentally conscious practices in their development and deployment.

7.2 Future Recommendations

Looking ahead, future advancements in IR remote and Bluetooth control for AC fan speed could focus on optimizing user experience, energy efficiency, and sustainability. Expanding compatibility across a wider array of AC fan models and types would ensure seamless integration and operation, regardless of the fan's make or model. Integrating smart features such as machine learning algorithms or occupancy sensors could enable automated fan speed adjustments based on user behavior or room occupancy, maximizing energy savings. Strengthening security measures in Bluetooth-enabled systems is crucial to safeguard user data and privacy.

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APPENDIX A

TURNITIN REPORT

192-33-5244

ORIGINALITY REPORT

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SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

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APPENDIX B

COMPLEX ENGINEERING PROBLEM SOLVING AND ENGINEERING ACTIVITIES

Provide your statement on which and how the complex engineering problems are being solved in the designed project. P1 is mandatory and some or all from P2 to P7.

Complex Engineering Problems (P) Solving		
	Attributes	Statement from students
P1	Depth of Knowledge	Programing, Electronics and Electrical
P2	Conflicting requirement	Here if I using IoT based control that would be good.
P3	Depth of analysis	This System has helped me in many courses like Engineering Drawing, Electronics circuits, Electronics, Computer programming, Digital Electronics, Microprocessor and interfacing, etc.
P4	Familiarity issue	In this project make need to gain extra knowledge like Arduino programming, and various types of instrumental behavior.
P5	Extend of applicable code	• Extend the code to recognize a broader range of IR remote commands or Bluetooth signals, allowing for customized fan speed adjustments based on diverse inputs. • Enhance the code to enable gradual or variable fan speed adjustments, providing smoother transitions and more nuanced control over the fan's RPM. • Extend Bluetooth control to integrate with smartphone applications, facilitating remote control, scheduling, or creating personalized settings for fan speed regulation. • Develop error-handling routines to address communication issues or faults, ensuring reliable and robust performance in various scenarios.
P6	Extend of stakeholder involvement and conflicting	N/A
P7	Interdependence	N/A

Provide your statement on which of the complex engineering activities are being solved in the designed project. Mention some or all of the following characteristics.

Complex Engineering Problems (P) Solving		
	Attributes	Statement from students
A1	Rainge of Resources or Diverse Resources	This project made me first get ideas from YouTube after getting more information from various journals and websites.
A2	Level of interaction between conflicting issues	Conflicting issues between IR remote and Bluetooth control for AC fan speed mainly involve signal interference, command conflicts, security versus accessibility, and compatibility challenges. These conflicts arise due to signal overlap, competing commands, the balance between security and ease of use, and compatibility issues among different protocols or versions. Resolving these conflicts requires strategic design considerations, prioritization protocols, and technological solutions to ensure reliable and seamless control over fan speed while mitigating conflicting signals and compatibility hurdles.
A3	Innovation	The innovation of IR remote and Bluetooth control for AC fan speed represents a transformative advancement in home automation, offering personalized and convenient control over environmental comfort. By integrating these technologies, users can remotely adjust fan speed using familiar IR remotes or smartphones connected via Bluetooth, enhancing accessibility and ease of use. This innovation not only revolutionizes comfort management but also aligns with energy efficiency goals, allowing tailored control for optimized energy consumption.
A4	Consequences to the Society and Environment	It is not harmful to our society and Environment but it is help to our power consumption.
A5	Familiarity of issues	Familiarity with issues related to IR remote and Bluetooth control for AC fan speed involves understanding signal interference, command conflicts, security considerations, and compatibility challenges. These issues revolve around potential signal disruptions, conflicting commands, balancing data security with accessibility, and ensuring compatibility among various protocols or versions. Adept navigation and resolution of these challenges are crucial for effective implementation and seamless operation of remote-controlled fan speed systems.

APPENDIX C

PROGRAM CODE

```
#include <SoftwareSerial.h>
#include <IRremote.h>
#include <TimerOne.h>            // Avaiable from
http://www.arduino.cc/playground/Code/Timer1
volatile int i = 0;              // Variable to use as a counter volatile as it is in an interrupt
volatile boolean zero_cross = 0;  // Boolean to store a "switch" to tell us if I have crossed
zero
int AC_pin = 11;                 // Output to Opto Triac
int dim = 0;                   // Dimming level (0-128)  0 = on, 128 = 0ff
int inc = 1;                    // counting up or down, 1=up, -1=down

int RECV_PIN = 3;
IRrecv irrecv(RECV_PIN);
decode_results results;

#define ONE 16753245
#define TWO 16736925
#define THREE 16769565
#define FOUR 16720605
#define FIVE 16712445
#define SIX 16761405
#define SEVEN 16769055
#define EIGHT 16754775
#define NINE 16748655
#define ZERO 16750695

SoftwareSerial myserial(7, 8);


int freqStep = 75;  // This is the delay-per-brightness step in microseconds.

int state = 0;
void setup() {  // Begin setup
  Serial.begin(9600);
  myserial.begin(9600);
  irrecv.enableIRIn();
  pinMode(AC_pin, OUTPUT);                    // Set the Triac pin as output
  attachInterrupt(0, zero_cross_detect, RISING);  // Attach an Interupt to Pin 2 (interupt 0)
for Zero Cross Detection
  Timer1.initialize(freqStep);                  // Initialize TimerOne library for the freq I need
  Timer1.attachInterrupt(dim_check, freqStep);
  // Use the TimerOne Library to attach an interrupt
  // to the function I use to check to see if it is
  // the right time to fire the triac.  This function
```

```
  // will now run every freqStep in microseconds.
}

void zero_cross_detect() {
  zero_cross = true;  // set the boolean to true to tell our dimming function that a zero cross
has occured
  i = 0;
  digitalWrite(AC_pin, LOW);  // turn off TRIAC (and AC)
}

// Turn on the TRIAC at the appropriate time
void dim_check() {
  if (zero_cross == true) {
    Serial.println(dim);
    if (i >= dim) {
      digitalWrite(AC_pin, HIGH);  // turn on light
      i = 0;                       // reset time step counter
      zero_cross = false;          //reset zero cross detection
    } else {
      i++;  // increment time step counter
    }
  }
}

void loop() {
  if (myserial.available() > 0) {  // Checks whether data is comming from the serial port
    state = myserial.read();       // Reads the data from the serial port

    if (state == '0') {
      Serial.println("0%");  // Send back, to the phone, the String "LED: ON"
      dim = 128;
    } else if (state == '1') {
      Serial.println("11%");
      ;
      dim = 112;
    } else if (state == '2') {
      Serial.println("22%");
      ;
      dim = 98;
    } else if (state == '3') {
      Serial.println("33%");
      ;
      dim = 84;
    } else if (state == '4') {
      Serial.println("44%");
      ;
      dim = 70;
    } else if (state == '5') {
      Serial.println("55%");
      ;
```

```
    dim = 56;
  } else if (state == '6') {
    Serial.println("66%");
    ;
    dim = 42;
  } else if (state == '7') {
    Serial.println("77%");
    ;
    dim = 28;
  } else if (state == '8') {
    Serial.println("88%");
    ;
    dim = 14;
  } else if (state == '9') {
    Serial.println("100%");
    ;
    dim = 0;
  }
}
// for IR
if (irrecv.decode(&results)) {

  if (results.value == ZERO)  //forward
  {
    Serial.println("0%");  // Send back, to the phone, the String "LED: ON"
    dim = 128;
  }

  else if (results.value == ONE)  //Right
  {
    Serial.println("11%");
    ;
    dim = 112;

  }

  else if (results.value == TWO)  //stop
  {
    Serial.println("22%");
    ;
    dim = 98;
  }
  // for Servo 1

  else if (results.value == THREE) {
    Serial.println("33%");
    ;
    dim = 84;

  }
```

```
    else if (results.value == FOUR) {
      Serial.println("44%");
      ;
      dim = 70;
    }
    // for Servo 2
    else if (results.value == FIVE) {
      Serial.println("55%");
      ;
      dim = 56;
    }

    else if (results.value == SIX) {
      Serial.println("66%");
      ;
      dim = 42;
    }
    // for Servo 3
    else if (results.value == SEVEN) {
      Serial.println("77%");
      ;
      dim = 28;
    }

    else if (results.value == EIGHT) {
      Serial.println("88%");
      ;
      dim = 14;
    }

    else if (results.value == NINE) {
      Serial.println("100%");
      ;
      dim = 0;
    }


    Serial.println(results.value);
    irrecv.resume();
  }

  delay(60);
}
```

APPENDIX D

DATASHEET OF COMPONENTS

1. Overview

Espressif's ESP8266EX delivers highly integrated Wi-Fi SoC solution to meet users' continuous demands for efficient power usage, compact design and reliable performance in the Internet of Things industry.

With the complete and self-contained Wi-Fi networking capabilities, ESP8266EX can perform either as a standalone application or as the slave to a host MCU. When ESP8266EX hosts the application, it promptly boots up from the flash. The integrated high-speed cache helps to increase the system performance and optimize the system memory. Also, ESP8266EX can be applied to any microcontroller design as a Wi-Fi adaptor through SPI/SDIO or UART interfaces.

ESP8266EX integrates antenna switches, RF balun, power amplifier, low noise receive amplifier, filters and power management modules. The compact design minimizes the PCB size and requires minimal external circuitries.

Besides the Wi-Fi functionalities, ESP8266EX also integrates an enhanced version of Tensilica's L106 Diamond series 32-bit processor and on-chip SRAM. It can be interfaced with external sensors and other devices through the GPIOs. Software Development Kit (SDK) provides sample codes for various applications.

Espressif Systems' Smart Connectivity Platform (ESCP) enables sophisticated features including:

- Fast switch between sleep and wakeup mode for energy-efficient purpose;
- Adaptive radio biasing for low-power operation
- Advance signal processing
- Spur cancellation and RF co-existence mechanisms for common cellular, Bluetooth, DDR, LVDS, LCD interference mitigation

1.1. Wi-Fi Key Features

- 802.11 b/g/n support
- 802.11 n support (2.4 GHz), up to 72.2 Mbps
- Defragmentation
- 2 x virtual Wi-Fi interface
- Automatic beacon monitoring (hardware TSF)
- Support Infrastructure BSS Station mode/SoftAP mode/Promiscuous mode

1 The Board

1.1 Application Examples

The UNO board is the flagship product of Arduino. Regardless if you are new to the world of electronics or will use the UNO as a tool for education purposes or industry-related tasks, the UNO is likely to meet your needs.

First entry to electronics: If this is your first project within coding and electronics, get started with our most used and documented board; Arduino UNO. It is equipped with the well-known ATmega328P processor, 14 digital input/output pins, 6 analog inputs, USB connections, ICSP header and reset button. This board includes everything you will need for a great first experience with Arduino.

Industry-standard development board: Using the Arduino UNO R3 board in industries, there are a range of companies using the UNO board as the brain for their PLC's.

Education purposes: Although the UNO R3 board has been with us for about ten years, it is still widely used for various education purposes and scientific projects. The board's high standard and top quality performance makes it a great resource to capture real time from sensors and to trigger complex laboratory equipment to mention a few examples.

1.2 Related Products

- Starter Kit
- Arduino UNO R4 Minima
- Arduino UNO R4 WiFi
- Tinkerkit Braccio Robot