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Development of DC Ceiling Fan using Android System

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ABSTRACT- This This paper describes the creation and execution of a new Android-based system that empowers users to have more control over energy-efficient DC ceiling fans. Utilizing wireless microcontrollers and Bluetooth technology, the system provides a cost-effective solution that can be adopted by a wide range of people. With a focus on accessibility for the elderly and those with physical limitations, the project offers a comprehensive control system that includes both manual and automatic settings, easily accessed through direct and remote methods. To further enhance the user experience and promote inclusivity, the project recommends integrating voice control functionality into the Android application. This advanced feature utilizes voice recognition technology to understand spoken commands, allowing for hands-free operation and catering to individuals with physical limitations or preferences. By incorporating voice control, the project underscores its commitment to user-centered design and accessibility, making a significant contribution to the development of smart home applications and the creation of a more comfortable living environment.

KEYWORDS: Android-based system, energy-efficient DC ceiling fans, wireless microcontrollers, Bluetooth technology, accessibility, elderly, physical limitations, control system, manual settings, automatic settings, remote control, voice control functionality, voice recognition technology, hands-free operation, user-centered design, smart home applications, comfortable living environment

I.INTRODUCTION

The increasing demand for smartphone-based control of electronic devices reflects a contemporary trend driven by advancements in mobile processing power and communication protocols. This evolution is particularly impactful for individuals with physical limitations, such as the elderly or those with disabilities, as it grants them the ability to remotely manage appliances effortlessly. This project leverages the ubiquitous nature of smartphones by utilizing an Android application to control a DC ceiling fan. This not only offers a modern solution but also empowers users with remote operation capabilities, eliminating the need for physical interaction with the appliance. With the continuous evolution of wireless technologies, options like Bluetooth Low Energy (BLE) and Wi-Fi have become fundamental elements of smart home applications. This project employs BLE, operating in the globally available 2.4 GHz band, allowing for a connection range of up to 100 meters and achieving data transfer speeds of up to 3 Mbps. The utilization of BLE ensures a reliable and secure communication channel between the mobile device and the fan control unit.

The Android application serves as the human-machine interface (HMI), providing a user-friendly platform for interaction with the DC ceiling fan. Through the application, users can transmit control commands to the fan and receive real-time feedback, including current settings and other relevant parameters. This streamlined communication enhances the overall user experience and exemplifies the project's commitment to merging modern technologies with practical solutions for smart home appliances. Furthermore, the integration of a voice control feature further augments accessibility and user-

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friendliness. Users can simply issue vocal commands to activate or deactivate the fan, adding an additional layer of convenience to the system. By incorporating voice control, the project aims to cater to a broader user base, encompassing individuals who might face challenges with traditional interfaces or those seeking hands-free operation.

II. PROBLEM IDENTIFICATION

1. Chances of shock with AC Appliances:
 - AC appliances, particularly those with exposed wires or faulty insulation, pose a significant risk of electric shock to users. Improper installation or maintenance can lead to electrical faults, increasing the likelihood of shocks.
2. Wastage of power with AC appliances:
 - AC appliances often consume a significant amount of electricity, especially if they are old or inefficient models. Inefficient cooling systems or improper usage, such as running the AC at unnecessarily low temperatures or leaving it on when not needed, can result in wasted energy.
3. No wireless operation, so direct contact with human beings:
 - Traditional AC appliances require manual operation using physical switches or remote controls, necessitating direct contact with the appliance.
4. Requires special switches and boards:
- AC appliances may require dedicated electrical circuits, special switches, or circuit boards to operate efficiently and safely. Installing or replacing these components can be costly and may require professional assistance, adding to the overall expense of using AC appliances.
5. No easier operation for children:
 - AC appliances often lack child-friendly features or controls, making them challenging for children to operate safely. Complex settings or inaccessible controls may lead to accidental misuse or improper handling by children, increasing the risk of accidents or injuries.
6. Accidental problems:
 - Accidental issues, such as spills or objects falling onto AC units, can damage the appliance or result in safety hazards.

III. PROPOSED SYSTEM

The Proposed system aims to revolutionize the traditional ceiling fan setup by integrating advanced technology and innovative design elements. It involves the development of a special arrangement for the fan, comprising a metallic plate, coupling, and locking mechanism. This arrangement is coupled with a high-performance DC motor rated at 12 volts and 4 amps, featuring an 8 mm thick shaft. The entire setup is controlled by an Arduino Uno microcontroller using a relay module, which utilizes electromechanical relays for precise switching of the motor. To enhance user accessibility and convenience, the system incorporates an Android-based application development tool. This tool allows for the creation of a custom Android application, empowering users to wirelessly control the fan from their smartphones. The application leverages Bluetooth technology operating at 2.4GHz to establish a seamless communication link between the Android device and the fan control module.

The Android application provides a user-friendly interface enabling users to send commands to the fan effortlessly. Users can adjust speed settings, activate or deactivate the fan, and access real-time data with ease. Moreover, the integration of voice control functionality adds another layer of convenience, allowing users to command the fan using voice prompts. This feature not only enhances accessibility but also elevates the overall user experience.

By offering remote control capabilities via a smartphone application, the proposed system promotes energy efficiency and user convenience. It enables users to manage their ceiling fan settings from anywhere within the vicinity, eliminating the need for manual intervention. With its innovative design and advanced features, the proposed system sets a new standard for modern ceiling fan control systems, aligning with the growing demand for smart home automation solutions.

IV.METHODOLOGY OF PROPOSED SURVEY

The operational methodology of the Android-based power-saving DC ceiling fan embodies a transformative approach to cooling technology, distinguishing itself from conventional AC counterparts. At the heart of this innovation is the DC motor, a pivotal component that adeptly converts electrical power from the supply into precise mechanical energy,

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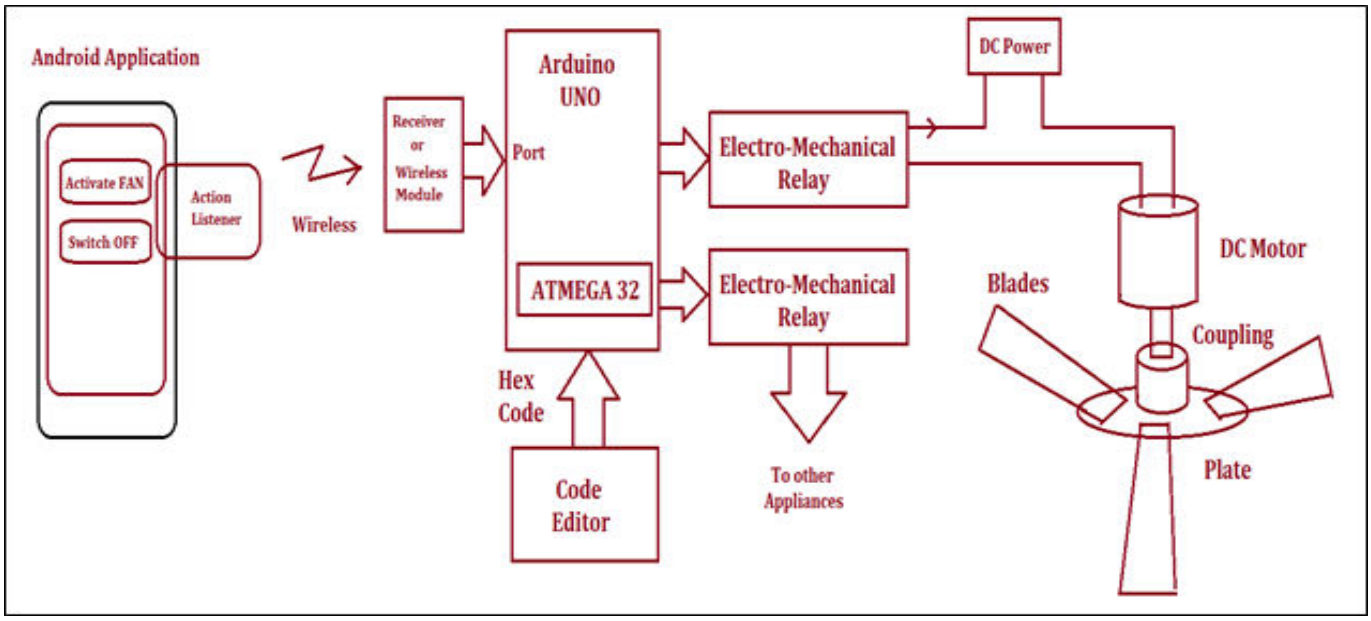
orchestrating the graceful rotation of the fan blades. This energy conversion is facilitated by a specialized power supply, meticulously transforming standard household AC power into low voltage DC power, aligning with the fan's energy-efficient design.



V.BLOCK DIAGRAM

The fan blades, intricately attached to the motor's shaft, assume a central role in the process, serving as the dynamic force behind the generation of airflow. Designed for optimal efficiency, these blades contribute to the fan's overall performance, delivering a cooling experience that seamlessly balances comfort with energy conservation. Complementing these mechanical elements is a sophisticated control system, directed by a microcontroller. This control hub intelligently processes signals originating from the remote control or integrated sensors, ensuring a nuanced and precise management of the fan's operation and settings. The microcontroller acts as the orchestrator of this symphony of functions, enabling users to seamlessly customize their cooling experience with remarkable accuracy. Integral to the user interaction is the Android App, a robust interface residing on smartphones or tablets. This app serves as the conduit for user commands, allowing for the seamless transmission of instructions to the fan and, reciprocally, the reception of real-time data. Through this interface, users gain not only immediate control over the fan's settings but also insights into current operational parameters.

Additionally, in this project, a special arrangement of the fan has been fabricated, including a metallic plate, coupling, and locking arrangement. The DC motor used features a 12V DC power supply with a 4 Amp current rating, coupled with an 8 mm thick shaft. The complete arrangement, controlled by an Arduino Uno using a relay module, incorporates electromechanical relays for switching the motor on and off. To enable an Android application-controlled system, the project utilizes an Android application development tool. To establish wireless functionality, a Bluetooth module operating on the 2.4GHz frequency band is employed. These additions further enhance the fan's functionality, usability, and energy-saving capabilities, making it a truly innovative and efficient cooling solution.

Android Application:

1. Manual Input: - The Android application offers a user-friendly interface allowing users to manually input instructions. This may involve selecting specific commands or toggling switches within the application. - Instructions are then converted into a string format suitable for transmission via Bluetooth.

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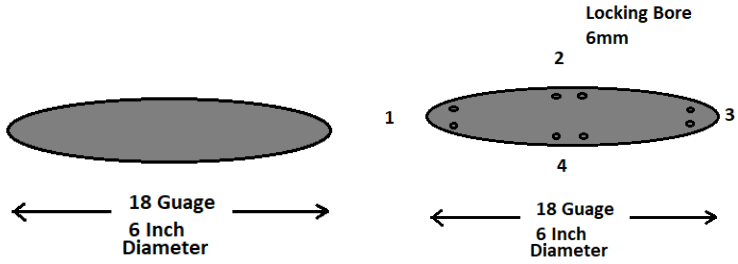
2. Voice-to-Text Conversion: - The voice-to-text feature enhances user convenience by enabling hands-free control. Users can speak commands into the application, and a voice-to-text converter translates spoken words into text instructions. - The Android application processes the converted text, ensuring accuracy and clarity of the instructions.

In this project fabricated a special arrangement of FAN which includes metallic plate , coupling and locking arrangement.



Specifications: Material Used: Mild Steel, 18 Gauge Thickness, 6 Inch Diameter, 6 mm Blade Locking Bore.This project uses 12v DC , 2500 RPM motor which carries 5 amp current rating. The DC Motor with 12v DC with 4 Amp current rating with shaft side 8 mm thick coupled with FAN arrangement. With the application of external power from the adapter complete arrangement starts to rotates. The complete arrangement i.e. which includes metallic plate , coupling and locking arrangement and motor controlled by Arduino Uno using relay module. Relay module uses electromechanical relay for switch ON and OFF Motor. Relay module works on 12v, 10 ampere so the output of relay module consists of 3 terminals.

1.Normally Closed 2.Normally Open 3.Common Contact

To make android application-controlled system, this project uses android application developer tool. To make system wireless the system used Bluetooth module which works on 2.4GHz.

VI. COMPONENT USED IN THE PROJECT

Arduino Uno, Relay Module, 12V 2 Amp Adapter, 12V 5 Amp Adapter, Coupling, Mild Steel Metal Plate, FAN Blades, Chassis, 2mm Wires, and Male to Female Wires are essential components utilized in the project.

Each component plays a vital role in the operation and functionality of the Android-based power-saving DC ceiling fan, contributing to its efficiency, reliability, and user-friendliness.

Arduino UNO:

The Arduino Uno boasts 14 digital I/O pins, with 6 of them capable of PWM output, alongside 6 analog inputs. It features a 16 MHz ceramic resonator (CSTCE16M0V53-R0), USB connectivity, a power jack, an ICSP header, and a reset button. Fully equipped to facilitate your microcontroller projects, it offers seamless connectivity options—whether via USB to your computer or through power supplied by an AC-DC adapter or batteries. Its user-friendly design encourages experimentation

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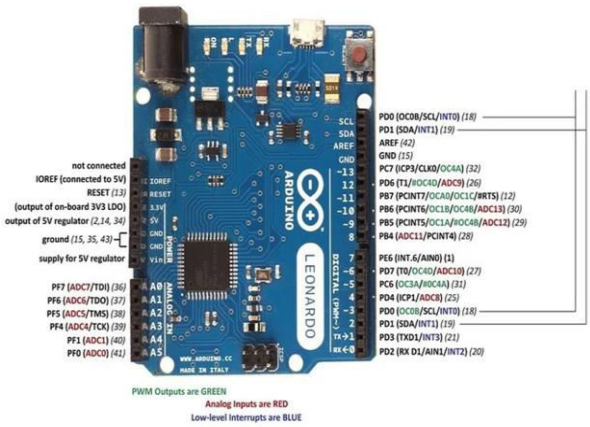
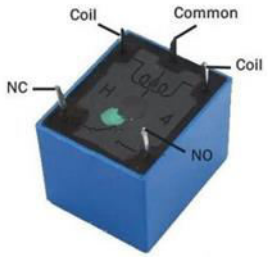
without the worry of permanent damage. In the event of mishaps, the chip can be replaced inexpensively, allowing for a fresh start.

The name "Uno," translating to "one" in Italian, commemorates the release of Arduino software (IDE) 1.0. The Uno board, in conjunction with Arduino Software (IDE) version 1.0, served as pivotal references for the Arduino platform and have been consistently updated to the latest iterations. As the inaugural board in the Arduino USB series, the Uno serves as a standard-setting model within the Arduino ecosystem. For a comprehensive overview of current, past, and legacy Arduino boards, consult the Arduino Board Index.

Pin configuration:



Electromechanical Relay :



A 5V relay serves as an automated switch commonly found in control circuits to manage high-current devices with low-current signals. The relay operates within a signal voltage range of 0 to 5V. The pin layout of the 5V relay is as follows:

Pin1 (End 1): This pin activates the relay; typically, one end is connected to a 5-volt source while the other end is grounded.

Pin2 (End 2): Used to activate the relay.

Pin3 (Common (COM)): Connects to the primary terminal of the Load to enable it.

Pin4 (Normally Closed (NC)): This terminal of the load is linked to either the NC or NO pins. When connected to the load, it remains ON before the switch.

Pin5 (Normally Open (NO)): When connected to the load, it turns the load off before the switch.The relay uses the current supply for opening or closing switch contacts. Usually, this can be done through a coil to magnetize the switch contacts & drags them jointly once activated. A spring drives them separately once the coil is not strengthened. By using this system,

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there are mainly two benefits, the first one is, the required current for activating the relay is less as compared to the current used by relay contacts for switching.

Motor for Ceiling Fan :

Specifications:

The ceiling fan boasts a robust operating voltage of 12V and a current rating of 5 Amp, ensuring efficient performance. Crafted from durable mild steel, the fan's construction guarantees longevity and reliability. With a rapid rotation speed of 2500 RPM, it swiftly circulates air throughout the room, providing optimal comfort. The body material, made of solid fiber, adds to its durability while the copper winding enhances its efficiency. Moreover, the substantial shaft thickness of 8 mm ensures stability and smooth operation.

The integration with Android offers unparalleled convenience, enabling users to control the ceiling fan remotely via a mobile application. This innovative feature empowers users to adjust fan settings from anywhere, providing flexibility and enhancing user experience. Whether adjusting speed settings or toggling power, users can effortlessly customize their cooling experience with ease and precision. This seamless integration of smart control and automation epitomizes modern living, offering unparalleled comfort and convenience at the touch of a button.

VII.ADVANTAGES

• Energy Efficiency:

DC ceiling fans are intrinsically more energy-efficient compared to their AC counterparts. The utilization of DC motors allows for precise management of fan speed and diminishes power usage, thereby fostering energy conservation.

• Variable Speed Control:

Android-based control facilitates variable speed settings for the ceiling fan. Users can easily customize the fan speed based on their comfort preferences and environmental conditions.

• Voice Control Capability:

If your project includes voice recognition features, users can control the ceiling fan using voice commands. This hands-free functionality adds an extra layer of convenience and modernizes the user experience.

• Environmental Friendliness:

The energy efficiency of DC motors makes Android-based DC ceiling fans more environmentally friendly. Lower power consumption translates to reduced carbon footprint and aligns with sustainability goals.

VIII.APPLICATIONS OF PROJECT

- **Can operate in cooling systems**: The ceiling fan's versatile functionality allows it to seamlessly integrate into various cooling systems, including air conditioning setups and evaporative
- **Ideal for schools and colleges**: In educational institutions, where large groups of people gather in classrooms and lecture halls, the ceiling fan's ability to effectively circulate air is crucial.

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- **Suitable for hospitals and public health centers**: Hospitals and healthcare facilities require optimal air quality and circulation to promote patient well-being and maintain hygiene standards.
- **Versatile household application**: In households, the ceiling fan serves as a staple cooling solution, providing relief from heat and humidity in various living spaces such as bedrooms, living rooms, and kitchens. Its energy-efficient operation makes it a cost-effective choice for maintaining indoor comfort year-round.
- **Ideal for flats, complexes:** In multi-unit residential buildings like flats and complexes, as well as large-scale commercial complexes the ceiling fan's widespread use ensures consistent airflow and comfort across diverse spaces. Its suitability for both residential and commercial settings makes it a versatile and practical cooling solution for modern urban environments.

IX.CONCLUSION

In summary, the Android-based DC ceiling fan represents the pinnacle of cooling technology evolution, seamlessly merging innovation and energy efficiency. With meticulously crafted components, from the precision-engineered DC motor to the intricately designed fan blades, this appliance not only provides a refreshing and comfortable cooling experience but also prioritizes sustainable and intelligent energy consumption.The integration of a user-friendly Android App, serving as an intuitive interface, combined with advanced communication modules, positions this ceiling fan as a leader in smart home appliances. It signifies a paradigm shift in how we interact with and perceive the role of ceiling fans in our daily lives. As we transition towards a future where smart living and energy-conscious choices are paramount, the Android-based DC ceiling fan emerges as a symbol of progress.Its seamless integration of cutting-edge technology with thoughtful design not only enhances user convenience but also underscores the potential for innovation in everyday appliances. This ceiling fan exemplifies the power of integrating intelligence and sustainability, setting a new standard for what is achievable in the realm of home comfort solutions.

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