A Project(Stage-I) Report

on

Dirt Defender Ceiling Fan

Submitted in partial fulfillment of the requirements
for the award of degree of

BACHELOR OF TECHNOLOGY

in

Information Technology

by

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CERTIFICATE

This is to certify that the Project report on **"DIRT DEFENDER CEILING FAN "** is a bonafide work carried out by **P. Neela (20WH1A1202), K. Mounika (20WH1A1222), B. Anika (20WH1A1232) and P. Akshitha (20WH1A1260)** in the partial fulfillment for the award of B.Tech degree in **Information Technology , BVRIT HYDERABAD College of Engineering for Women, Bachupally, Hyderabad** affiliated to Jawaharlal Nehru Technological University, Hyderabad, under my guidance and supervision. The results embodied in the project work have not been submitted to any other university or institute for the award of any degree or diploma.

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DECLARATION

We hereby declare that the work presented in this project entitled **"DIRT DEFENDER CEILING FAN"** submitted towards completion of in IV year I sem of B.Tech IT at "BVRIT HYDERABAD College of Engineering for Women", Hyderabad is an authentic record of our original work carried out under the esteemed guidance of **Ms. D. Sangeetha, Assistant Professor**, Department of Information Technology.

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ABSTRACT

Dirt Defender Ceiling Fan system, a revolutionary approach to simplify the upkeep of ceiling fans commonly found in homes and commercial spaces. In response to the persistent issue of fan blades accumulating dust and debris, which can not only diminish their efficiency but also present a daunting cleaning task, this innovative system employs cutting-edge technology and design features to provide a practical solution. The heart of the system lies in its ability to autonomously detect dust accumulation through specialized sensors, akin to the way our eyes perceive things. When these sensors identify a significant amount of dust on the fan blades, they promptly send a message to a dedicated mobile app specifically tailored for self-cleaning ceiling fans. Users are then empowered to take control with a simple tap on the app, initiating the cleaning process. This operation relies on clever mechanical components that employ small brushes or rubber wipers to gently and effectively clean the fan blades, ensuring they remain dust-free. What sets this system apart is its integrated dust collection mechanism, wherein the removed dust is efficiently stored in a designated container. This collected dust can be effortlessly released at the user's discretion, eliminating the need for manual cleaning and the associated hassles.

Keywords: Cleaning Task, Sensors, Dust Collection Mechanism, Brushes.

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Chapter 1

Introduction

Dirt Defender Ceiling Fan system is an innovative solution poised to transform the landscape of fan maintenance. This groundbreaking system revolutionizes the upkeep of ceiling fans by seamlessly integrating cutting-edge technology with practical design elements. Addressing the persistent challenge of dust accumulation on fan blades, this system heralds a new era in fan maintenance by employing specialized sensors that mimic human perception to autonomously detect dust buildup.

By leveraging a dedicated mobile app, users are empowered to initiate the cleaning process effortlessly with a simple tap, eliminating the need for manual intervention. The system's mechanical components, including small brushes or rubber wipers, ensure gentle yet highly effective cleaning, optimizing fan performance without inconvenience. Moreover, the integration of an innovative dust collection mechanism efficiently stores removed dust in a designated container, offering users unparalleled convenience in fan upkeep.

1.1 Motivation

The motivation driving the development of the Dirt Defender Ceiling Fan system stems from the inherent challenges of maintaining ceiling fans. Dust accumulation on fan blades poses a significant issue, impacting both fan efficiency and the arduousness of cleaning. Recognizing the inconvenience and time-consumingnature of traditional cleaning methods, this innovative system is designed to simplify the maintenance process by proactively detecting dust accumulation through advanced sensors.

This proactive approach not only streamlines fan upkeep but also contributes to sustainability by reducing energy wastage associated with dust-laden blades.

Moreover, by incorporating user-friendly controls via a dedicated mobile app and integrating a smart dust collection mechanism, the system aims to alleviate the burden of manual cleaning while ensuring optimal fan performance. Ultimately, the motivation behind the Dirt Defender Ceiling Fan system is to redefine fan maintenance, offering users a hassle-free and efficient solution that enhances fan longevity and performance.

1.2 Objective

The primary objective driving the development of the Dirt Defender Ceiling Fan system is to redefine and streamline the maintenance process of ceiling fans. This innovative system aims to revolutionize fan upkeep by utilizing cutting-edge technology, including specialized sensors, to autonomously detect dust accumulation on fan blades. Through this proactive approach, the system seeks to reduce the need for manual cleaning, ensuring optimal fan performance while prolonging the fan's lifespan. Additionally, the integration of a dedicated mobile app empowers users to effortlessly initiate the cleaning process with a simple tap, providing a user-friendly experience. The system's mechanical components, such as brushes or wipers, facilitate gentle and effective cleaning, optimizing fan efficiency without requiring constant user intervention. Moreover, the innovative dust collection mechanism efficiently stores removed dust, eliminating the inconvenience of manual cleaning and enhancing the overall convenience of fan maintenance. Ultimately, the objective of the Dirt Defender Ceiling Fan system is to introduce a comprehensive, technology-driven solution that simplifies fan upkeep, extends fan longevity, and ensures optimal performance in residential and commercial settings

1.3 Problem Definition

The current method of maintaining ceiling fans presents significant challenges, primarily revolving around the accumulation of dust on fan blades. Manual cleaning processes are time-consuming, often neglected, and cumbersome due to the difficulty of reaching and thoroughly cleaning each blade. This accumulation not only diminishes the fan's efficiency but also poses a considerable challenge in ensuring optimal performance. Moreover, the lack of a proactive approach to addressing dust buildup leads to increased energy consumption and reduced longevity of ceiling fans. The absence of an efficient dust collection mechanism further exacerbates the inconvenience and environmental impact, requiring frequent and labor-intensive cleaning efforts. Additionally, the limitations in existing maintenance methods hinder the seamless operation of ceiling fans, ultimately affecting user convenience and satisfaction. In essence, the persistent issue of dust accumulation on fan blades underscores the necessity for an innovative and efficient solution that simplifies upkeep, enhances performance, and reduces manual intervention in maintaining ceiling fans.

Chapter 2

Literature Survey

The literature survey for the project ”IoT-Enabled Vacuum Cleaner Using Arduino” encompasses a thorough exploration of several interconnected domains. It begins by extensively examining the integration of Internet of Things (IoT) technology into home automation systems and smart devices, specifically focusing on the role of IoT in enhancing convenience and efficiency in household tasks, including cleaning appliances. Discussions revolve around the evolutionary trajectory of automatic vacuum cleaners, emphasizing the incorporation of robotics, smart technologies, and the shift towards autonomous and IoT-enabled vacuum robots for efficient cleaning of diverse spaces. Within this context, emphasis is placed on the pivotal role of microcontrollers, such as Arduino Mega, and sensor technologies, notably HC-SR04 ultrasonic sensors, in enabling obstacle detection, navigation, and path planning algorithms to facilitate efficient cleaning operations. Furthermore, the survey delves into wireless control mechanisms, smartphone integration, and user-friendly interfaces, highlighting the incorporation of wireless modules like the ESP8266 receiver to enable remote control through smartphone applications such as Blynk. The literature also encompasses discussions on remote monitoring, autonomous functionalities, and seamless operation, underscoring the importance of features that enable users to monitor and control cleaning processes remotely, facilitating autonomous cleaning operations without direct supervision. This holistic review of pertinent literature provides foundational insights into technological advancements, user-centric functionalities, and the integration of IoT in smart vacuum cleaners, forming a crucial basis for the development of the IoT-enabled automatic vacuum cleaner using Arduino outlined in the project. [[1] The literature survey for the project ”Designing a Smart Vacuum Cleaner” begins with an exploration of Wireless Sensor Networks (WSN) in home automation, emphasizing their integration into smart home systems for enhanced convenience and efficiency. Extensive research in this domain showcases the evolution of cleaning systems, highlighting the transition from traditional vacuum cleaners to advanced, compact, and less intrusive smart devices suitable for office, public spaces, and homes. Within the context of smart cleaning devices, robotics and autonomous navigation systems have been extensively studied, focusing on algorithms, sensors, and mapping techniques that enable autonomous movement and environment mapping. Furthermore, literature reviews emphasize user-centric studies, emphasizing user preferences, usability, and satisfaction factors when using smart cleaning appliances. Discussions also encompass challenges faced in achieving full autonomy, efficiency, and scalability in smart vacuum cleaners, while exploring future directions such as enhancing navigation, optimizing cleaning algorithms, and integrating emerging technologies to further improve performance. [2] The literature survey conducted for the paper "Glass Cleaning Robot for High Rise Buildings" encompasses an in-depth examination of existing research on automated cleaning systems, particularly emphasizing their application in high-rise structures with glass facades. This survey explores the challenges inherent in manual cleaning processes and highlights the risks involved for human workers, underscoring the need for safer and more efficient solutions. It reviews prior studies on robotic cleaning systems, focusing on their mechanisms for traversing vertical glass surfaces, including structural designs, pneumatic systems, suction technologies, and control mechanisms. Moreover, the survey recognizes the expanding relevance of robotics in addressing maintenance issues in smart buildings and identifies potential applications beyond high-rise structures, such as in the cleaning of large solar panels. Ultimately, this literature review underscores the crucial research objective of designing and implementing a specialized cleaning robot tailored for glass-covered buildings, aiming to significantly enhance safety and operational efficiency in high-rise building maintenance practices. [3] The literature survey for the project "Design and Implementation of Automated Cleaning of Ceiling Fan" encompasses a comprehensive exploration of multiple facets associated with automated cleaning systems, mechanisms, and pertinent technologies. This survey embarks on a detailed investigation into existing literature, focusing on the evolution and significance of automated cleaning systems across diverse domains, including industries, households, and specialized environments. It delves into the mechanisms and technologies employed in automated cleaning setups, emphasizing the integration of innovative solutions to streamline the process of fan cleaning. This exploration includes a critical review of mechanical setups, such as scissor lift mechanisms and lead screw arrangements, while emphasizing the pivotal role of control mechanisms, microcontrollers, sensors, and actuators within these systems. The survey also underscores the importance of portability in cleaning systems and addresses challenges in implementation, economic feasibility, safety measures, user acceptance, and potential avenues for future innovations. This comprehensive review amalgamates diverse research findings, laying the groundwork for informed decisions in designing and implementing automated cleaning solutions tailored specifically for ceiling fans. [4] The literature survey for the paper "Design and Development of a Glass Cleaning Robot" encompasses an investigation into autonomous cleaning robots, focusing on their climbing mechanisms, control systems, vacuum technologies, safety features, battery management, and future prospects. It explores existing research on robots designed for cleaning, specifically addressing their capabilities on vertical surfaces like glass, while delving into control mechanisms, suction systems, and motion planning algorithms vital for efficient cleaning. Additionally, it scrutinizes safety measures like fraud detection, emphasizes battery efficiency for prolonged operations, and highlights challenges and potential research avenues for enhancing these autonomous glass cleaning systems. [5]

Chapter 3

System Design

3.1 Proposed System

The proposed Dirt Defender Ceiling Fan system offers a groundbreaking solution to the perennial problem of ceiling fan maintenance. Utilizing state-ofthe-art technology, this innovative system is designed to simplify the upkeep of both residential and commercial ceiling fans. At the core of its functionality are specialized sensors, reminiscent of human eyes, adept at autonomously detecting dust buildup on fan blades. Once significant accumulation is detected, these sensors communicate with a dedicated mobile app, empowering users to trigger the cleaning process effortlessly. This process involves ingeniously designed mechanical components employing gentle brushes or rubber wipers to effectively remove dust from the fan blades. What distinguishes this system is its integrated dust collection mechanism, efficiently storing the removed debris in a designated container. This collected dust can be conveniently disposed of at the user's convenience, eliminating the laborious manual cleaning traditionally associated with ceiling fan maintenance.

3.2 Architecture

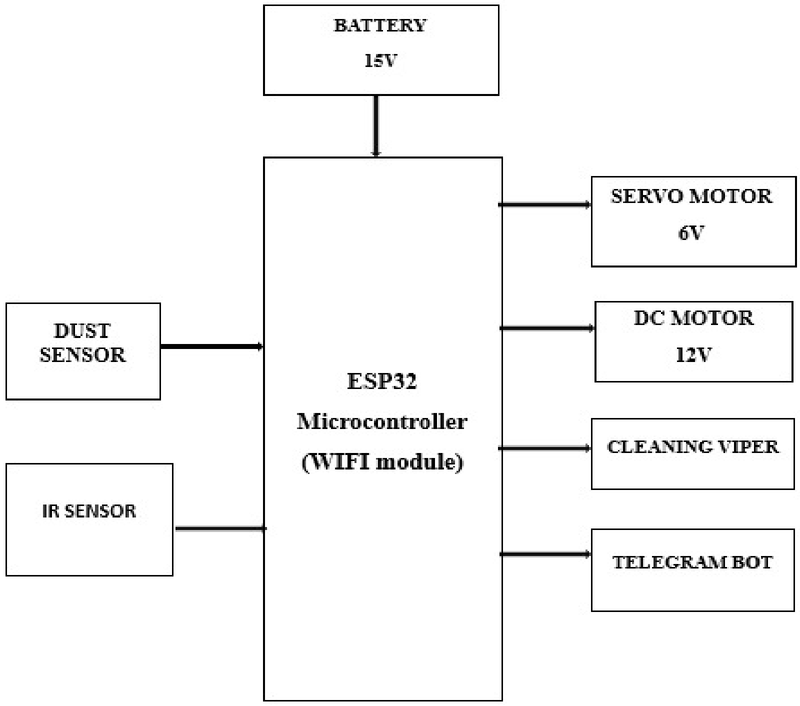

Figure 3.1: Dust-Free Delight Architecture

3.3 Hardware Design

3.3.1 Power Supply

The power supply section is the section which provide +5V for the components to work. IC LM7805 is used for providing a constant power of +5V. The ac voltage, typically 220V, is connected to a transformer, which steps down that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripples and also retains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

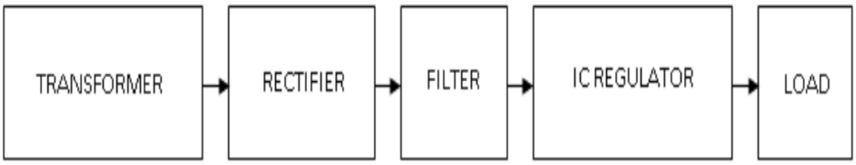

Figure 3.2: power Supply

- **Transformer :** Transformers are vital for converting AC electricity between voltage levels with minimal energy loss, working exclusively with AC currents, which is why mains electricity predominantly uses AC. They step up or down voltage levels—step-up increases, while step-down decreases—to make mains voltages safer for various applications. These devices, comprising primary and secondary coils within a magnetic field, demonstrate high efficiency by converting input power almost equivalently to output power, crucial in power supply systems for delivering stable voltages to electronic devices.

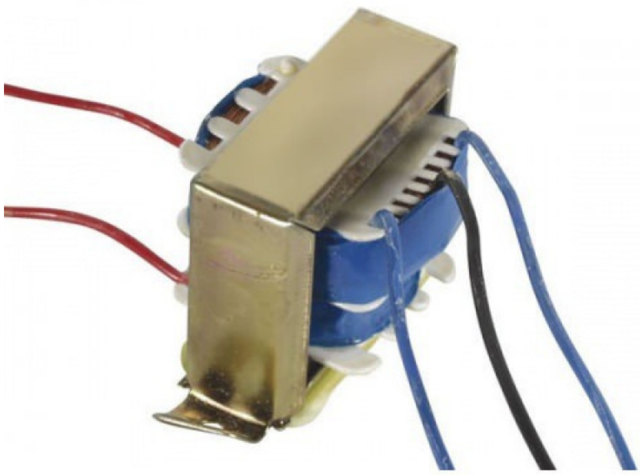

Figure 3.3: Transformer

3.3.2 ESP32

ESP32 is a series of low-cost, low-power system on a chip microcontrollers with integrated Wi-Fi and dual-mode Bluetooth. The ESP32 series employs either a Tensilica Xtensa LX6 microprocessor in both dual-core and single-core variations, Xtensa LX7 dual-core microprocessor or a single-core RISC-V microprocessor and includes built-in antenna switches, RF balun, power amplifier, lownoise receive amplifier, filters, and power- management modules. ESP32 is created and developed by Espressif Systems, a Shanghai- based Chinese company, and is manufactured by TSMC using their 40 nm process. It is a successor to the ESP8266 microcontroller.

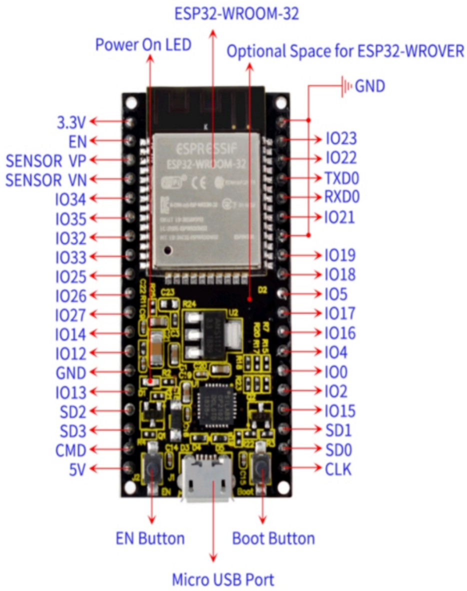

Figure 3.4: ESP32

3.3.3 Servo SG90

The SG90 servo, a prevalent miniature actuator, features diminutive dimensions (approximately 23mm x 12mm x 29mm) yet delivers noteworthy torque of 1.5 to 2.5 kg/cm and operates at a speed of 0.1 to 0.2 seconds per 60 degrees rotation without a load. Operating within a 4.8V to 6V voltage range, it relies on a small DC motor intricately connected to reduction gears, facilitating precise positioning aided by a potentiometer feedback mechanism. Controlled via pulse width modulation (PWM) signals ranging from 1ms to 2ms, this servo is extensively used in radio-controlled models, robotics, and automation, offering a rotational span of approximately 180 degrees to enable accurate angular adjustments, making it a favored choice for diverse applications in hobbyist projects and small-scale mechanisms.

Figure 3.5: Servo SG90

3.3.4 DC Motor :

A DC motor in simple words is a device that converts direct current(electrical energy) into mechanical energy. It's of vital importance for the industry today. A DC motor is designed to run on DC electric power. Two examples of pure DC designs are Michael Faraday's homo-polar motor (which is uncommon), and the ball bearing motor, which is (so far) a novelty. By far the most common DC motor types are the brushed and brushless types, which use internal and external commutation respectively to create an oscillating AC current from the DC source—so they are not purely DC machines in a strict sense. We in our project are using brushed DC Motor, which will operate in the ratings of 12v DC 0.6A. The speed of a DC motor can be controlled by changing the voltage applied to the armature or by changing the field current. The introduction of variable resistance in the armature circuit or field circuit allowed speed control. Modern DC motors are often controlled by power electronics systems called DC drives.

Figure 3.6: DC Motor

3.3.5 Motor Driver

L293D IC generally comes as a standard 16-pin DIP (dual-in line package). This motor driver IC can simultaneously control two small motors in either direction; forward and reverse with just 4 microcontroller pins (if you do not use enable pins).

Some of the features (and drawbacks) of this IC are :

1. Output current capability is limited to 600mA per channel with peak output current limited to 1.2A (non-repetitive). This means you cannot drive bigger motors with this IC. However, most small motors used in hobby robotics should work. If you are unsure whether the IC can handle a particular motor, connect the IC to its circuit and run the motor with your finger on the IC. If it gets really hot, then beware... Also note the words ”non-repetitive”; if the current output repeatedly reaches 1.2A, it might destroy the drive transistors.
2. Supply voltage can be as large as 36 Volts. This means you do not have to worry much about voltage regulation.
3. L293D has an enable facility which helps you enable the IC output pins. If an enable pin is set to logic high, then state of the inputs match the state of the outputs. If you pull this low, then the outputs will be turned off regardless of the input states
4. The datasheet also mentions an ”over temperature protection” built into the IC. This means an internal sensor senses its internal temperature and stops driving the motors if the temperature crosses a set point
5. Another major feature of L293D is its internal clamp diodes. This flyback diode helps protect the driver IC from voltage spikes that occur when the motor coil is turned on and off (mostly when turned off)

6. The logical low in the IC is set to 1.5V. This means the pin is set high only if the voltage across the pin crosses 1.5V which makes it suitable for use in high frequency applications like switching applications (upto 5KHz)
7. Lastly, this integrated circuit not only drives DC motors, but can also be used to drive relay solenoids, stepper motors etc

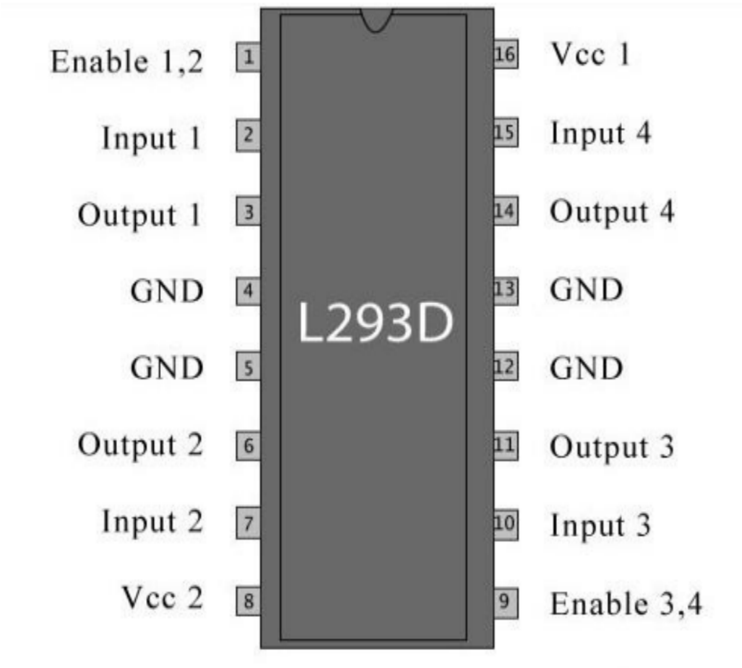

Figure 3.7: L293D

3.4 Software Design

3.4.1 Arduino Software

We need to download the Arduino Software package for your operating system. When we've downloaded and opened the application you should see something like this:

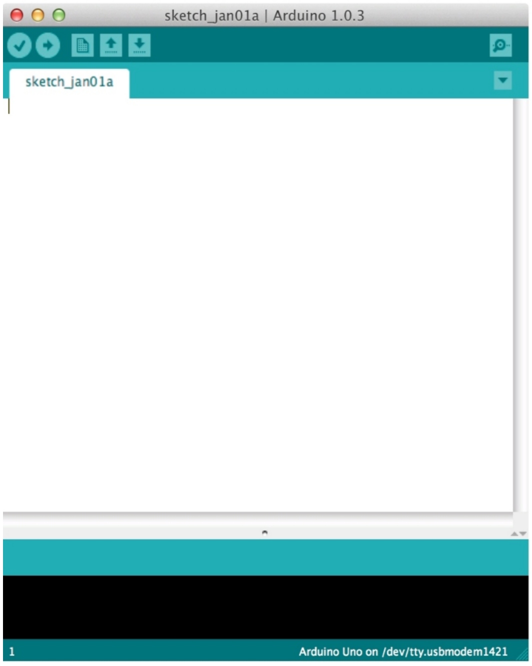

Figure 3.8: Arduino IDE

This is where you type the code you want to compile and send to the Arduino board.

3.4.2 The Code

The code you write for your Arduino are known as sketches. They are written in C++.Every sketch needs two void type functions, setup() and loop(). A void type function doesn't return any value.

The setup() method is ran once at the just after the Arduino is powered up and the loop() method is ran continuously afterwards. The setup() is where you want to do any initialisation steps, and in loop() you want to run the code you want to run over and over again.

So, basic sketch or program should look like this:

```
void setup() {
}
void loop() {
}
```

Now we have the basic skeleton in place we can now do the Hello, World program of microcontrollers, a blinking an LED.

Now let's try and switch it on using the HIGH constant.

```
int ledPin = 13;

void setup() {

pinMode(ledPin, OUTPUT); }

void loop() {

digitalWrite(ledPin, HIGH);
}
```

Press Upload again and you should see your LED is now on! Let's make this a little more interesting now. We're going to use another method called delay() which takes an integer of a time interval in milliseconds, meaning the integer of 1000 is 1 second.

So after where we switch the LED on let's add delay(2000) which is two seconds, then digitalWrite(ledPin, LOW) to switch it off and delay(2000) again.

```
int ledPin = 13;

void setup() {

pinMode(ledPin, OUTPUT); }

void loop() {

digitalWrite(ledPin, HIGH);
```

```
delay(2000);

digitalWrite(ledPin, LOW);

delay(2000);

}
```

3.4.3 Telegram bot

We've incorporated a Telegram bot for system control, simplifying the process. This bot acts as a convenient interface, enabling users to manage the system remotely using Telegram, a messaging app. By sending simple commands through the bot, such as adjusting lighting or checking system status, users can swiftly and easily control the functionalities of the system, enhancing accessibility and user-friendliness. This integration allows for seamless interaction with the system, making it more convenient and efficient for users to operate and monitor the functionalities through a familiar messaging platform.

The Telegram Bot API utilizes HTTPS via the WiFiClientSecure library in our Arduino code, ensuring a secure and encrypted communication channel between our device and the Telegram servers. This allows our Arduino-based application to send and receive messages to and from Telegram users or groups securely over the internet.

Chapter 4

Implemention

4.1 Circuit Diagram

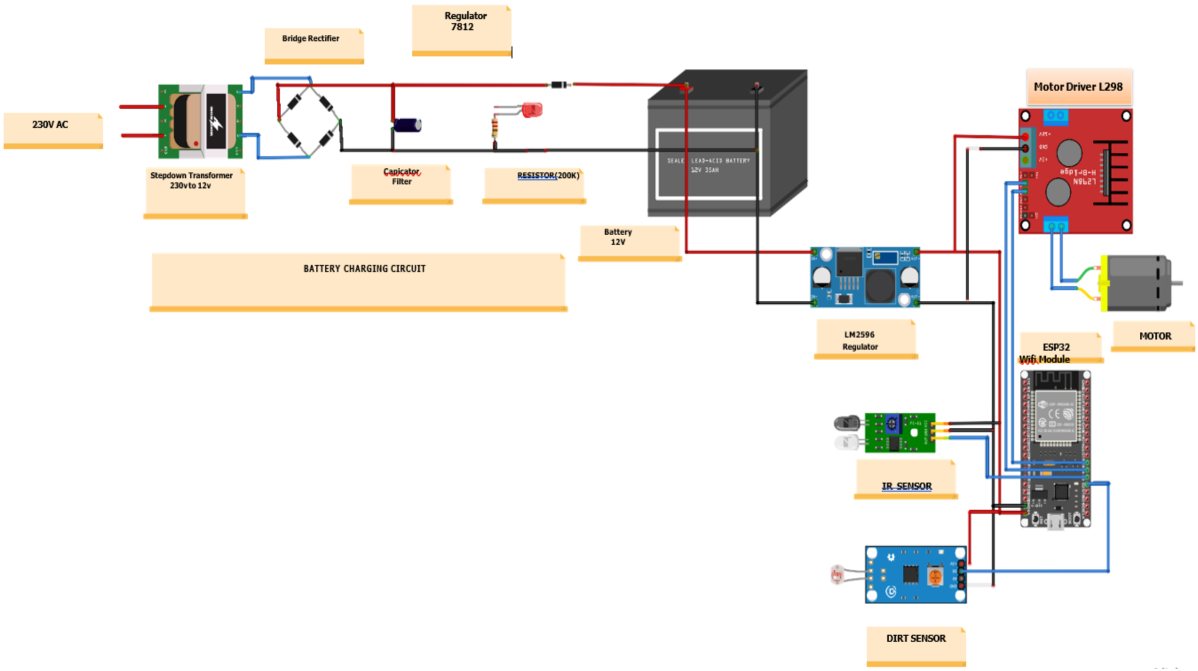

Figure 4.1: Dust-Free Delight Circuit Diagram

4.2 System Modules

1. **Sensor Module:**
   - Dust Detection Sensors: Specialized sensors mounted on fan blades to detect dust accumulation.
   - Communication Protocols: Interface enabling data transmission from sensors to the control unit.
2. **Cleaning Mechanism:**
   - Mechanical Components: Brushes or rubber wipers strategically positioned and activated to clean fan blades.
   - Motor Control System: Controls the movement and speed of the cleaning components.
   - Cleaning Patterns: Algorithms defining the movement patterns for optimal cleaning coverage.
3. **Telegram bot :** The Telegram bot module enables remote system control via the Telegram app. It acts as an interface, allowing users to easily manage functions like cleaning using. simple commands. This integration enhances accessibility and user-friendliness by providing a familiar platform for system interaction

4.3 Algorithm

- Step 1 - Initialization sensor, motors, IOT
- Step 2 – Checking if sensor gets triggered.
- Step 3 – Update the servo motor position
- Step 4 – If Direct sensor trigger move the cleaning robot in that direction
- Step 5 – Stop

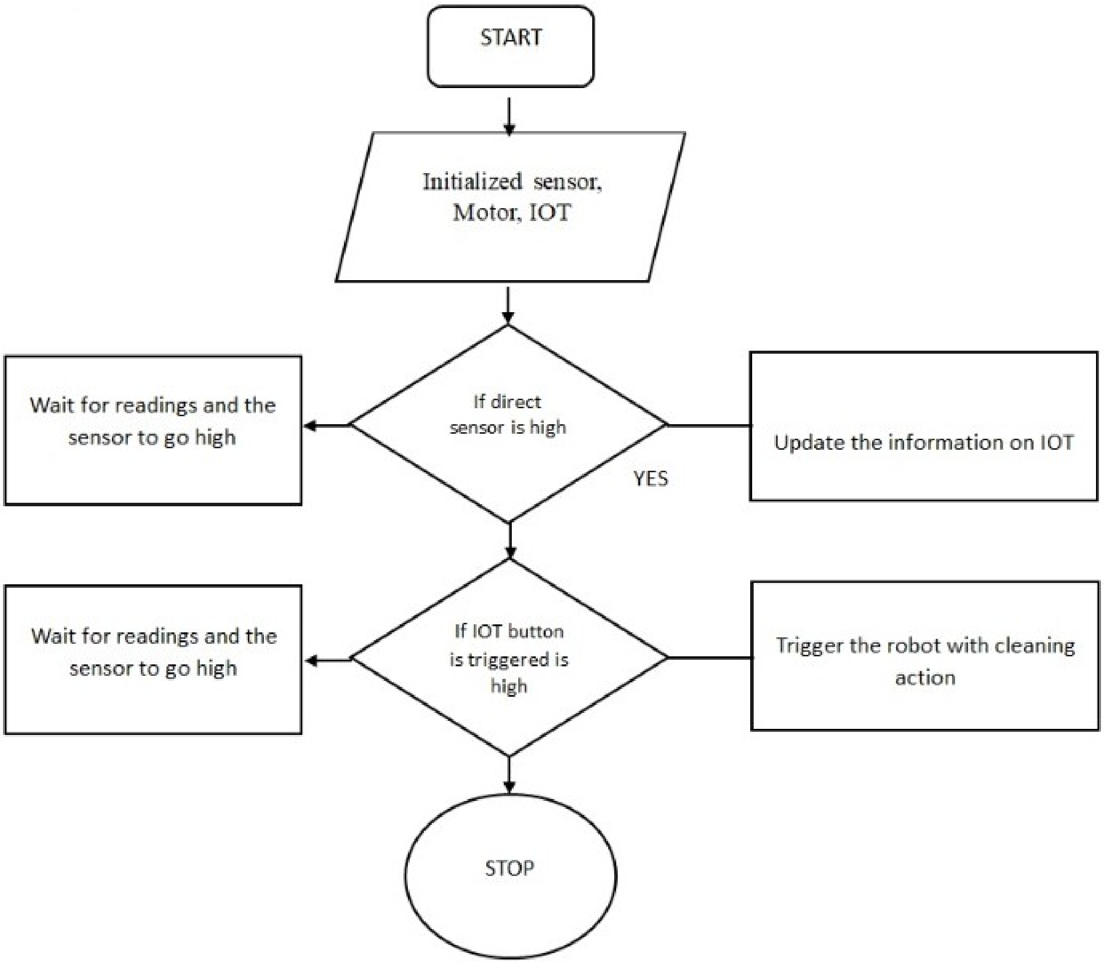

Figure 4.2: Dust-Free Delight Flowchart

Chapter 5

Partial Implementation and Results

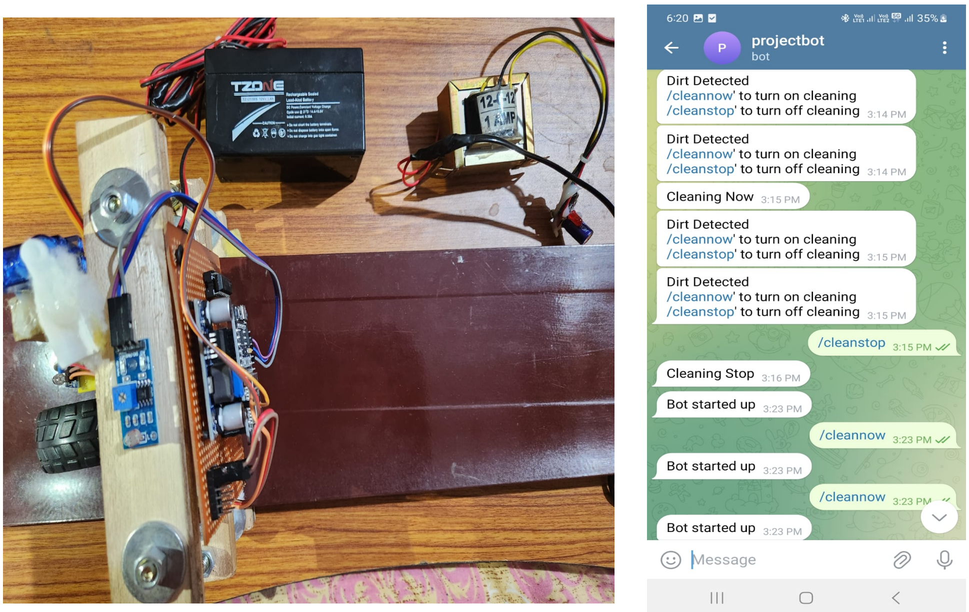

Figure 5.1: Cleaning mechanism is activated and notification got in Telegram bot

Chapter 6

Conclusion and Future Scope

In partial implementation, the cleaning mechanism within the Dirt Defender Ceiling Fan system exhibits promising strides in revolutionizing fan maintenance. The autonomous detection system, facilitated by specialized sensors, accurately identifies dust accumulation, initiating a user-controlled cleaning process through a dedicated mobile app. The mechanism's ingenious mechanical components, employing small brushes or rubber wipers, effectively remove dust, ensuring the fan blades remain free of debris. The integrated dust collection system further enhances convenience by efficiently storing removed particles in a designated container, ready for easy disposal at the user's discretion. This initial implementation demonstrates a significant leap toward hassle-free fan maintenance, showcasing a blend of innovative technology and practical design. However, further real-world testing and user feedback will be crucial to fine-tune and assess the system's efficacy in diverse environments before its full-scale deployment.

Future advancements in dust collection and removal systems like the Dirt Defender Ceiling Fan might include increased storage capacity, improved disposal methods, upgraded filtration for better air quality, advanced sensors for adaptive cleaning, self-maintenance features, and energy-efficient designs, aiming to enhance user-friendliness and effectiveness in maintaining cleaner indoor spaces

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