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Design And Implementation Of A Voice - Activated Autonomous Spraying Drone For Precision Agriculture

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***Abstract*---This paper presents the design and implementation of a voice-activated autonomous spraying drone for precision agriculture. The system uses voice commands to control the drone's flight, enabling farmers to operate the drone hands-free and focus on other important tasks. The drone is equipped with a GPS system and a spraying mechanism that allows it to navigate and spray crops accurately. The system uses a neural network-based or bluetooth voice recognition system to accurately interpret voice commands and control the drone's movements. The experimental results show that the proposed system is capable of achieving high accuracy and efficiency in crop spraying tasks, while reducing the workload and improving the safety of farmers. Overall, the voice-activated autonomous spraying drone system has the potential to revolutionize the agriculture industry by improving crop yield and reducing labor costs.**

Keywords- drone , agriculture , arduino, voice control , Bluetooth module , pump ,spray

I. INTRODUCTION

A voice-controlled agriculture spray drone is a type of drone that is designed to spray pesticides, herbicides, or fertilizers on crops using voice commands. The drone is equipped with a spray nozzle and a tank containing the necessary chemicals or fertilizers.

The voice control system allows farmers to operate the drone using simple voice commands, making it easier to control the drone while working in the field. The system recognizes the farmer's voice and interprets the commands, allowing the drone to be flown and controlled remotely.Some of the benefits of a voice-controlled agriculture spray drone include increased efficiency, reduced costs, and improved accuracy in crop spraying. The system eliminates the need for manual control, reducing labor costs and minimizing the risk of human error.

The drone can cover a larger area in a shorter amount of time, increasing overall productivity. It can also be programmed to fly specific routes, ensuring that the chemicals are applied evenly and accurately across the crops.

However, there are some potential downsides to consider, such as the cost of the drone, the need for proper training and maintenance, and the potential for privacy concerns if the drone is equipped with cameras or other surveillance equipment. It is important to carefully evaluate these factors before deciding whether a voice-controlled agriculture spray drone is a viable solution for a particular farm or agricultural operation.

Voice control technology is an innovative way of controlling agricultural drones for spraying operations. Agricultural drones equipped with voice control technology can provide farmers with a faster, more efficient, and precise way of spraying crops, leading to increased productivity, and reduced operational cost.

II. WORKING PRINCIPLE

The working principle of a voice-controlled agriculture spray drone involves using voice commands to control the drone's movements and spray functions.

A voice-controlled agricultural spray drone is a type of unmanned aerial vehicle (UAV) that is designed to spray crops with pesticides or fertilizers using voice commands. The working principle of this drone involves several components.

The operation of the voice-controlled agricultural spray drone involves the following steps:The operator gives voice commands to the drone to start its engines and take off.The drone takes off and flies over the crops while following a pre-programmed flight path.The operator gives voice commands to the drone to start the spraying process.

The drone activates its spray mechanism and begins to release pesticides or fertilizers over the crops. The drone continues to fly over the crops and release the spray until it has covered the entire area. Once the spraying is complete, the drone returns to its starting point and lands.

When the farmer gives a voice command, the microphone records the sound and converts it into an electrical signal. The signal is then sent to the speech recognition software, which analyzes the sound wave and compares it with a pre-determined set of voice commands. If the software recognizes the command, it sends a signal to the flight control system to execute the corresponding action.

The voice input system consists of a microphone or other audio input device that captures voice commands from the user. The

microphone may be integrated into the drone or may be a separate device that is connected to the drone via wireless or wired connection.

The speech recognition system is responsible for processing the voice input and interpreting the user's commands. This may involve converting the voice input into text using automatic speech recognition (ASR) technology, which can then be processed by a natural language processing (NLP) system to identify the intended command.

Once the user's command has been identified, the control system for the drone takes action to carry out the command. This may involve Times New Roman Times New Roman adjusting the drone's flight path, adjusting the spray pattern, or performing other tasks as specified by the user's command.

A voice-controlled agriculture spray drone works on the principle of integrating voice recognition technology with drone technology to enable farmers to control the drone using their voice commands. The drone is equipped with a microphone that listens for specific voice commands from the farmer, which are then processed by the onboard computer using natural language processing algorithms. The computer then sends instructions to the drone's flight controller, which controls the drone's movement.

III. METHODOLOGY

VOICE CONTROLL DRONE USING ARDUINO

Firstly, that the drone is powered by an Arduino Pro Mini Board or an UNO R3 SMD. Both of these boards are based on the ATmega328 microcontroller and can be programmed using the Arduino IDE. The Arduino board acts as the brain of the drone and controls its various components, such as the motors, sensors, and communication modules.

The motors of the drone can be that allows you to vary the width of the pulse to control the amount of power that is sent controlled using PWM (Pulse Width Modulation) pins on the Arduino board. PWM is a technique to the motor. By varying the width of the pulse, you can control the speed and direction of the motor. This is essential for controlling the movement of the drone.

To control the drone using voice commands, you have established a Bluetooth connection between your Android smartphone and the HC-05 Bluetooth module connected to the Arduino board. The HC-05 module is a popular Bluetooth module that can be used to establish a wireless communication link between the Arduino board and other Bluetooth-enabled devices, such as our smartphone. The module can be connected to the Arduino board using the RX and TX pins, and it communicates with the board using the Serial Communication Protocol.

By the by we have used various applications such as BYLNK, IFTTT, and BT voice control for Arduino to transmit voice commands from your smartphone to the Arduino board. BYLNK is a mobile application that allows you to create custom control panels for Arduino projects. With BYLNK, you can create a custom control panel with buttons, sliders, and other user interface components, and then connect it to your Arduino board over Bluetooth or Wi-Fi. IFTTT (If This Then That) is a web-based service that allows you to create simple automation tasks between different web applications and services. With IFTTT, you can create applets that trigger an action on one service based on an event on another service. For example, you can create an applet that sends a voice command from your smartphone to the Arduino board when you say a specific phrase to your Google Assistant. BT voice control for Arduino is an Android application that allows you to control your Arduino projects using voice commands. With BT voice control, you can define custom voice commands and then map them to specific actions on your Arduino board.

Some features:

Voice control: The ability to control the drone using voice commands is a major feature of this project. By using an Android smartphone and various applications, you have created a custom voice control system that allows you to control the drone using natural language commands.

Arduino board: The use of an Arduino board as the brain of the drone provides a flexible and customizable platform for controlling the various components of the drone. The Arduino board can be easily programmed using the Arduino IDE and can be connected to a wide range of sensors, communication modules, and other electronic components.

PWM motor control: The use of Pulse Width Modulation (PWM) pins to control the motors of the drone allows for precise control over the speed and direction of the motors. This is essential for controlling the movement of the drone and ensuring that it can be controlled accurately.

Bluetooth communication: The use of a Bluetooth module to establish a wireless communication link between the drone and an Android smartphone allows for easy and convenient control of the drone. By using various Bluetooth-enabled applications, you can transmit voice commands, control panels, or other data to the drone from your smartphone.

Internet connectivity: By connecting a nano MCU to the internet, you can control the drone remotely using a mobile application or a web-based interface. This allows you to control the drone from anywhere in the world and provides a wide range of possibilities for remote control and monitoring.

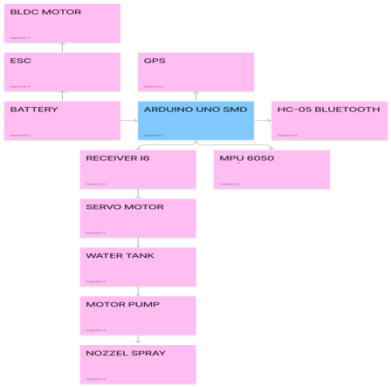

FIG 1: AERCHITECTURE DIAGRAM

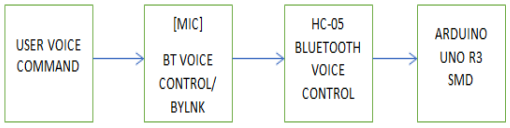

FIG 2: TRASMITER SECTION

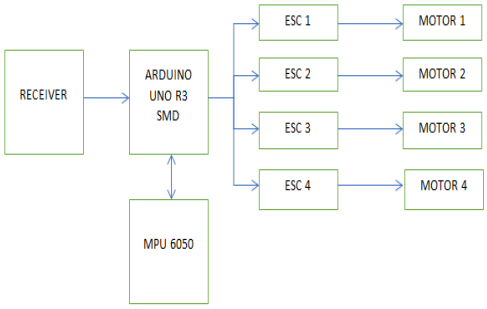

FIG 3: RECEIVER SECTION

MPU 6050 SENSOR MODULE INTERFACING WITH ARDUINO UNO FOR DRONE

The MPU-6050 sensor module is a popular choice for drone applications due to its ability to provide precise measurement of acceleration and angular velocity.

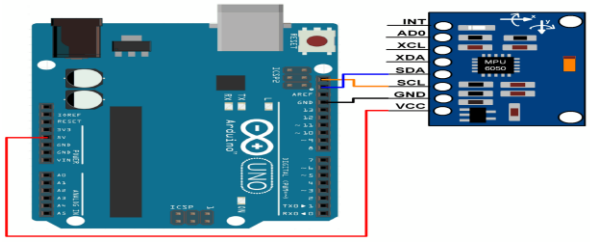

FIG 4: INTERFACING MODULE

HC-05 BLUETOOTH MODULE INTERFACING WITH ARDUINO UNO FOR DRONE

The HC-05 Bluetooth module is a commonly used wireless communication module in drone applications.

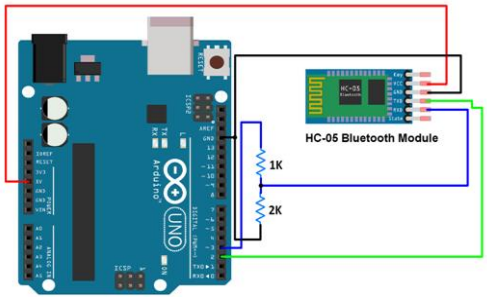

FIG 5: INTERFACING MODULE

IV.COMPONENTS

ARDUINO UNO R3 SMD:

The purpose of this report is to outline the steps involved in building a voice-controlled drone using an Arduino Uno R3 SMD microcontroller board. This report will discuss the components required, the wiring connections needed, and the programming necessary to enable the drone to respond to voice commands. The report will also highlight the importance of following safety guidelines and regulations when building and operating a drone.

To build a voice-controlled drone, several components are required. These include motors, propellers, ESCs (Electronic Speed Controllers), a flight controller, a microphone, and an audio processing module. It is essential to ensure that all components are compatible with the Arduino Uno R3 SMD microcontroller board.

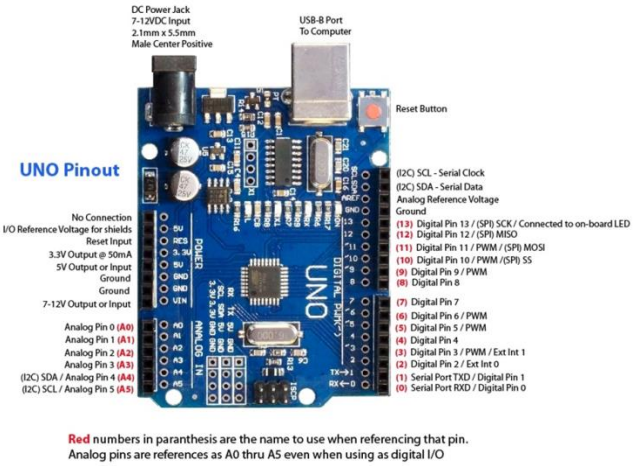

FIG 6: ARDUINO BOARD

MPU 6050 SENSOR MODULE

The MPU-6050 is a popular 6-axis motion tracking device that can be used in a variety of applications, including drone stabilization and orientation sensing.

FIG 7: MPU 6050

HC-05 BLUETOOTH MODULE:

The HC-05 Bluetooth module is a commonly used wireless communication component that can be employed in various applications. For the purpose of voice control drones, the HC-05 module can be used to establish a wireless connection between the drone and a mobile device.

FIG 8: BLUETOOTH MODULE

GPS MODULE

A GPS (Global Positioning System) module is an essential component of a drone that allows it to determine its position and altitude accurately. A GPS module receives signals from a network of satellites orbiting the Earth and calculates the drone's precise location using trilateration.

WATER TANK

The water tank for an agricultural spray drone plays a crucial role in the successful operation of the drone for spraying crops. It holds the water and/or chemicals that are used to spray the crops, and its capacity and design are critical to the efficient and effective use of the drone for crop spraying. The water tank must be durable, lightweight, and designed to fit the drone's contours for stable flight. It should have a reliable outlet for controlled water flow, a secure lid for easy filling and cleaning, and should be mounted securely to the drone. Properly designed and used, the water tank can help increase crop yields, reduce labor costs, and minimize the use of harmful chemicals in agriculture.

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NOZZLE SPRAY

The nozzle spray system in agriculture spray drones works by delivering a liquid mixture of pesticides or fertilizers to the crops through nozzles mounted on the drone. The liquid mixture is stored in a tank, and a pump is used to create pressure to push the mixture through the nozzles. The nozzles convert the liquid into droplets that are sprayed over the crops in a specific pattern.

TESTING AND DISCUSSION OF QUADCOPTER

9.1 BUILD OF QUADCOPTE

Initially the quadcopter was build using Aluminium C-shape channel and Mica sheet ,it was unsuccessful due to the selection of C- shape channel and unavailability of Square channel of 1 sq.cm. Finally the quadcopter the proposed system is used to take the application for its purpose. The Quadcopter was build by using the components listed in previous chapter. The main frame was selected that are easily available for the development of the quadcopter. Here the base of F550 Naza developed frame is used to build the frame. All the components are fixed on the frame.

ESC CALIBRATION

- ESC calibration is an important step when building a drone as it ensures that the electronic speed controllers (ESCs) are synchronized and calibrated with the flight controller. Here are the steps to calibrate ESCs using an Arduino Uno:
- **Connect the ESCs**: Connect each ESC to the Arduino Uno using jumper wires. The red wire should be connected to the 5V pin, the black wire to the GND pin, and the signal wire to digital pins 9, 10, 11, and 12. Make sure each ESC is properly connected and powered on.

LANDING GEAR

The landing gear used for quadcopter is inspired of four leg supported system. The hinger are attached to the quadcopter base plate where it consists of four hinger screwed to the base plate. The shocker leg is selected such as that easily attached or detached when they are required. Even the shocker leg are supported to the ceramic coated rods to firmly support and protects from the impact. The whole landing gears prevent the sudden impact act on the vehicle. It absorb by simplistic design of expanded leg to arrest sudden impact. It as fabric layer for soft landing over the rods to ensure the softness and grip over landing the system.

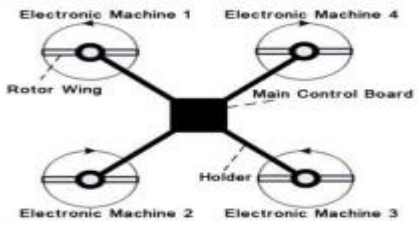

FIG 9: DESIGN OF QUADCOPTER

V. CONCLUSION

In conclusion, voice control technology has emerged as a powerful tool in the field of agriculture spray drones. The advantages of using voice control in agriculture spray drones are many and varied. By enabling operators to control drones with their voice, voice control technology can significantly improve the efficiency and effectiveness of crop spraying operations. One of the key advantages of voice control is that it allows operators to control multiple drones at once, reducing labor costs and increasing efficiency. Additionally, voice control can help make precise adjustments to the spraying system based on data from sensors and other sources. This can help optimize the use of resources, improve crop yields, and reduce waste.

Voice control technology is also particularly useful in specialty crops and organic farming. In these situations, voice control can be used to reduce the use of chemicals and minimize the impact on the environment. By making precise adjustments to the spraying system, waste can be reduced and spraying can be done in a targeted and effective manner. Furthermore, voice control technology can improve the safety of the operation by reducing the need for physical controls and allowing the operator to focus on the task at hand.

The customization options available with voice control technology also make it easier to optimize the performance of the drone and spraying system for each specific crop and task. This flexibility enables operators to fine-tune the spraying system to meet the specific needs of each crop, leading to improved crop yields and reduced waste.

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