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Military Surveillance Drone

[1]Sneha Gulhane , [2]Janhavi Abruk , [3]Anjali Raut , [4]Prachi Poharkar , [5]Shravani Kale ,[6]Shrejal Gawaner, [7]Shri R.M.Gharat

[123456]Students, Electronics Engineering.[7]HOD, Electronics Engineering.
Dr. Panjabrao Deshmukh Polytechnic, Amravati, Maharashtra, India.

ABSTRACT :-

This research presents the design and development of a First-person view(FPV) drone An FPV drone is an unmanned aerial vehicle (UAV) tailored for military surveillance and reconnaissance missions. The FPV integrates a 4K_resolution camera system optimized for real-time intelligence gathering. Controlled via a secure mobile interface, the drone offers portability and ease of operation, enabling rapid deployment in field scenarios. Key features include a lightweight design, Reusable battery life, low acoustic signature, and robust communication systems to ensure mission continuity under challenging conditions. It has a range of about 1 KM and a flight time of 10-12 minutes on (not so vigorous) flying conditions.

Keyword: - FPV (first person view), UAV, Drone, ZY-H12RX, Real-Time Intelligence.

1. Introduction

FPV (first person view) drone, they are generally referred as military drones, these are pilotless aircraft which are remotely controlled by the operators. military operations are revolutionized by these drones, it enables the operation or the task which are dangerous or impractical for humans. Initially they were primarily used for surveillance and military survey, unmanned aerial vehicle (UAVs) have changed gradually overtime. UAVs have the capabilities to carry sensors, cameras. he device which can wirelessly send the data or photos to displays, headsets, mobile devices, and other displays are known as FPV drones.

The user can achieve still photographs while having a first-person perspective of the drone's surroundings. FPV drones can be operate remotely. It can fly without causing harm to human lives. It is Equipped with 4K Resolution cameras. The project aims to show how small, lightweight drones can enhance surveillance missions by providing real-time data with minimal operational complexity [6]

2. Literature Review

The paper by W. A. Siddiqui et al. focuses on the design and fabrication of an FPV racing drone using the SP Racing F3 flight controller. It emphasizes stability, PID tuning, and performance optimization. The drone achieved a 3 km range and 11–12 minutes of flight time, showcasing its effectiveness for high-speed applications [1]

H. Ali et al.'s paper presents the development of an IoT-enabled surveillance drone for industrial security. It integrates components like Arduino Uno, Raspberry Pi B+, and an HD camera for real-time video monitoring via a mobile app. The system allows remote access and control, enhancing surveillance in hazardous or restricted industrial areas [2]

The research done by Brig (Dr) Navjot Singh Bedi (Retd), titled "Drones as Force-Multiplier in Future Wars", explores the transformative role of drones in modern warfare. It discusses how advancements in drone technology such as AI integration, swarm capabilities, and high-altitude platforms enhance operational efficiency while minimizing human risk. The study also addresses challenges like electronic warfare vulnerabilities and the need for robust countermeasures, emphasizing drones' potential to revolutionize military strategies and act as significant force multipliers in future conflicts[3]

Brig (Dr) Navjot Singh Bedi (Retd) discusses the evolving role of drones as force multipliers in modern warfare. The paper highlights advancements such as AI integration, swarm capabilities, and high-altitude platforms that enhance operational efficiency while minimizing human risk. It also addresses challenges like electronic warfare vulnerabilities and emphasizes the need for robust countermeasures to fully leverage drones' potential in future conflicts [4]

He, Chan, and Guizani (2017) examined the integration of drones into public safety networks, focusing on security challenges and solutions. they discuss how drones can enhance emergency response capabilities by providing real-time aerial surveillance and communication support. The study also addresses

security concerns such as data privacy, network vulnerabilities, and the need for robust encryption and authentication mechanisms to ensure the integrity and confidentiality of information transmitted by drone-assisted systems. The authors propose strategies to mitigate these risks and optimize the use of drones in public safety applications.[7]

Ahirwar et al. (2019) emphasize the role of drones in enhancing agricultural efficiency through applications like crop monitoring, irrigation, and soil analysis. The study highlights drones as a key tool for precision farming, improving yields while reducing labor and input costs.[10]

3. Methodology :-

A. Block Diagram

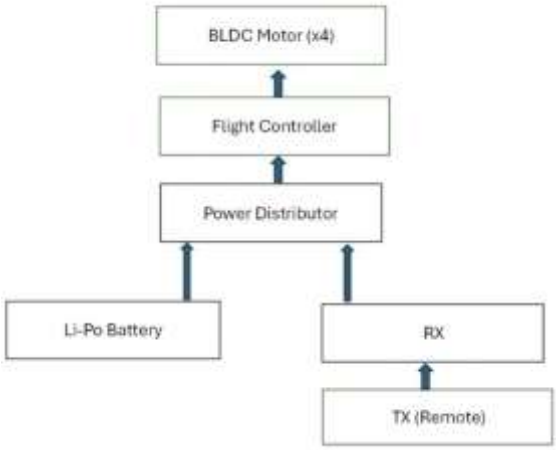

Figure 1: Block diagram of military surveillance drone

The above figure shows the block diagram of military surveillance drone it has 4 BLDC motors, flight-controller, power distributer, receiver, transmitter(remote).

1. Li-po battery: it is the power source of the drone which will supply the electric energy to the drone it has high energy and it is lightweighted which make it ideal for microdrone it sends power to the power distributor, which is responsible for the distribution of the energy to the other parts of the drone efficiently.
2. Power distributor: power distributor takes the energy from li-po battery and provide it to various components like the Flight Controller and the Receiver (RX). It ensures that each component receives the correct amount of current and voltage, preventing overload or damage. This is responsible for the stable operation of the drone.
3. TX (Transmitter) and RX (Receiver): Communication Bridge

The TX is the remote control used by the operator to send commands to the drone. These commands are transmitted without wires to the RX, which is present on the drone. The RX (Receiver) captures the control signals and forwards them to the Flight Controller. This communication link allows the pilot to control the drone's movement, speed, and direction remotely.

4. Flight Controller: Flight Controller is called as Brain of the drone, the Flight Controller is the central processing unit of the drone. It receives input from the RX, understand those commands, and combines them with onboard sensor data (like gyroscope, accelerometer, etc.). Based on the given information, it makes decisions about how to control the motors. The flight controller plays a critical role in stabilizing the drone and executing commands such as take-off, landing, and directional movement.
5. BLDC Motors (x4): There are four Brushless DC (BLDC) motors is mostly used in UAV drones. These motors are responsible for movement of the propellers that lift the drone. The Flight Controller sends signals to these motors, adjusting their speed to perform various movements like ascending, descending, tilting, or rotating. BLDC motors are chosen for their efficiency, reliability, and high torque-to-weight ratio.

B. Descriptions

Frame

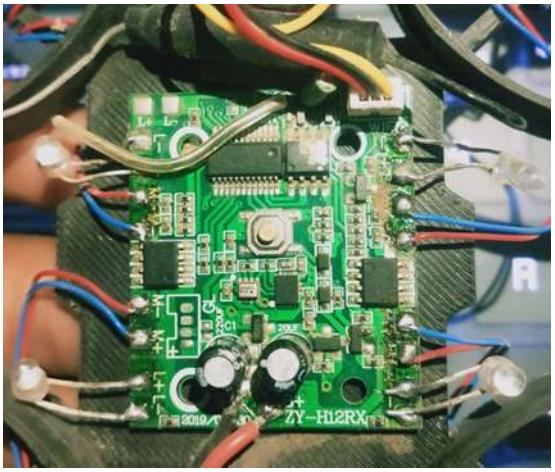

Figure 2: ZY-H12RX

The frame is called as the backbone of the drones which supports all the essential components of the drone the ZY-H12RX is the compact, designed small drones it is lightweighted and its durable construction makes it best choice for applications where the size and weight are the critical factors.

This drone frame has all the flight characteristics which are required for every drone frame. A well-designed frame must be lightweighted, should have a proper balance and performance. the parts of drone are connected in such a manner that gives excellent aerodynamic performance. This drone is light for take-off and strong enough to whole the structure this drone frame protects all the sensitive electrical components of the drone.

This drone frame has 1km external receiving antenna and have the ESP32's processing power. This low power circuit uses less power and supports the low power mode states. There is another nice feature that it can easily connect the Wi-fi network you can also create a Wi-fi network to enable the connection for another devices.

Camera

Figure 3: TX06 Split FPV CAM

This camera is the best choice for the micro drones as it is lightweighted

Camera: This camera have the 700TVL (total value locked) resolution which provides good clarity to the operator.

Weight: the weight of the camera is 1.8g, which makes it ideal for the microdrones where the weight is considered as critical factor.

Power: the unit is rated at 25mW of power transmission which is sufficient for the range short to medium FPV flying perfect for the small drones it also help to keep the power consumption low.

Propellers

Figure 4: Propellers

The Propellers spin and generate the difference between the top and bottom of the propellers to create a lift due to this pressure difference it pushes the air in one direction which creates a strong force which is enough to lift the drone against the gravity propellers helps to maintain the stability of the drone with the help of propellers the drone can move in different directions the number of blade, size , pitch and the material of the drone's propeller affects the drone's performance.

Motors

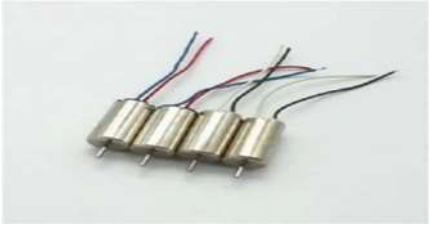

Figure 5: Motors

The motors used in UAV drones are typically electric motors which are chose based on the type of drone, its purpose, and the required performance characteristics. These motors are broadly categorized into brushed DC motors and brushless DC motors, the brushless motors are commonly used for most UAVs due to their efficiency and reliability. A drone motor is a type of electrical motor which is specially designed for use in drones. These motors are crucial components and provide the necessary thrust to the drone which leads the drone propellers to lift the drone into the sky. Drone motors come in various sizes and power rating depends on the requirements of Unmanned aerial vehicles (UAVs).These motors are made lightweight and compact for good performance and efficiency by minimizing the overall weight of the drone. They are made to deliver a high level of power output with less energy consumption, thereby increasing flight time and endurance.

Battery

Figure 6: Battery

Due to the lightweight, high energy density, and ability to deliver high current (discharge rates) the Lithium Polymer (LiPo) batteries are the most widely used batteries in UAV drones.

These characteristics make these batteries ideal for providing the necessary power to the drone for stable and efficient drone flight. Each LiPo cell has a nominal voltage of 3.7V and a fully charged voltage of 4.2V.

Lithium Battery USB Cable

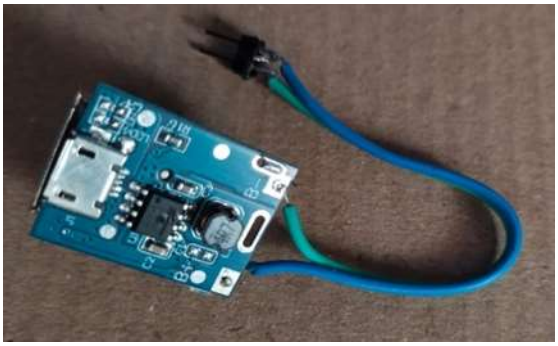

Figure 7: USB Cable

This USB cable which is a portable battery pack designed to charge electronic devices on the go in short it is a power bank . It contains battery cells that store and release electricity, making it a convenient backup power source. This is available in various sizes and capacities, from the high-capacity to compact pocket-sized models. this models also support fast charging technology for quick power delivery. makes it ideal for travel, outdoor activities, and emergencies.

Remote controller

Figure 8: E99 Pro 4K HD drone remote controller

The E99 Pro 4K HD drone remote controller is designed for both beginners and experienced users, it offers seamless flight control and stable footage capture. It pairs with a foldable drone featuring a 4K HD dual camera, providing a flight time of 5-25 minutes, depending on the model and battery. The controller allows for one-key take-off and landing, 360° flips, and adjustable speed levels, while the drone's six-axis gyroscopic stabilization ensures smooth flight. Compact and portable, it is ideal for both indoor and outdoor use.[6]

C. **Steps to build a drone**: -

Step 1: Choose a frame.

Step 2: Select the propellers and motors.

Step 3: Choose a Flight Controller.

Step 4: Select the Transmitter and Receiver.

Step 5: Choose a Battery and Power Distribution System.

Step 6: Assemble the Components properly on the frame.

Step 7: Assemble the Camera and the Motor on frame.

Step8: check drone is ready or not, then connect propellers and battery.

Step 9: Configure Flight Controller and connect the receiver to the drone.

Step10: Do the final Test and fly.

First, we will print the frame using a 3D printer and attach the controller chip to the base of the frame. Next, will fix the motor and propeller to the side of the drone. After connecting the battery, will supply power to the motors which will cause them to start rotating. We will then test the functionality of the drone by connecting it to the transmitter. The drone will be controlled through the transmitter, and since it is small and lightweight, it will face fewer challenges during flight. However, its lightweight design may get affected by the wind. A camera will be mounted on the drone, allowing real-time images to be transmitted to a mobile phone via the KYFPV app. The drone design is adaptable, allowing modifications to the circuit, making it a cost-effective and easy-to-handle product. Its small size enables it to be flow in compact spaces, requiring less room than larger drones.

D. **Flowchart :-**

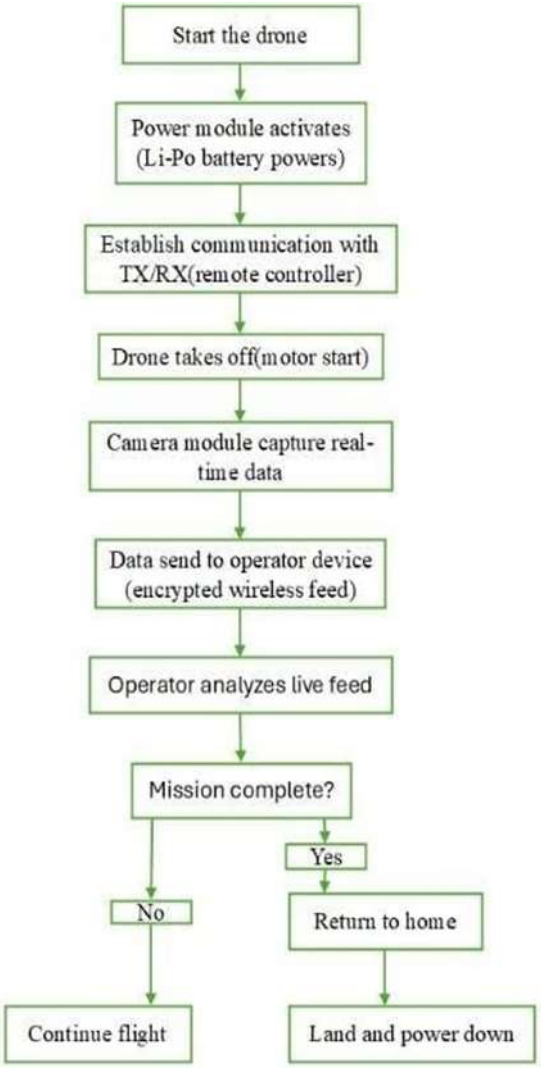

Figure 9: Flow Chart of Military Surveillance Drone.

E. Result :-

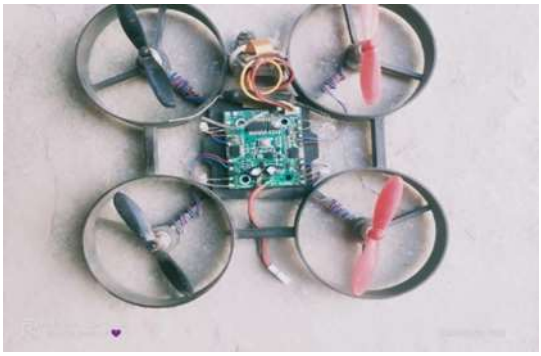

Figure 10:- Drone Frame

Figure 11: Pictures Captured By Camera

Figure 12: App Interface

4. Conclusion:

The objective of this project is for surveillance on the military areas, during military operation there are some places where the human being can't go for surveillance there are some hazarders places where are solder is to take risk for the surveillance and for reducing the life threat of the soldier we have design the project. This project has camera of 4k resolution which will provide high resolution pictures through the FVP mobile application we can also monitor real time video of the particular areas. We have made sure the drone is lightweight so it will be easy to handle.

While the drone was initially developed for defence applications, its potential extends to many other fields. It can be used in agriculture for crop monitoring, disaster management for search and rescue operations, wildlife observation, industrial inspections, urban surveillance, media production, and even in educational environments to teach UAV technology and wireless communication. Its modular and adaptable design makes it a flexible tool for various real-world scenarios where portability, live data collection, and cost efficiency are critical.

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