



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 12, December 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118

9940 572 462

6381 907 438

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F4V3S PLUS BASED DRONE

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ABSTRACT- This research's main objective is to develop an Unmanned Aerial Vehicle-based system for monitoring forest fires in real time (UAV). The UAV is equipped with sensors, an Omnibus F4 V3S Plus Flight Controller Board, and a Belheli 4 in 1 ESC for Speed control. Gyrometer, barometer, and accelerometer are three integrated sensors on the flight control board (FCB). The first is a Gyro sensor, which kept the observed forest area balanced. There are more sensors that the FCB can link to externally. They are a compass sensor, a barometer, a GPS, and an inertial measurement unit (IMU). The navigation system uses a compass and GPS. The barometer recorded the air pressure, which was used as a reference point to maintain the UAV's height. The FCB's gyroscope and accelerometer sensors are used to calculate the position of the vehicle. Both the sensor and GPS data are stored in the FCB. The results of the data processing are delivered back to the website by the server, where they are immediately made available online. TCP, or Transmission Control Protocol, was utilised for the data transport. The UAV's flight path is selected using a mission planner so that it can fly by itself.

I. INTRODUCTION

Unmanned aerial vehicles (UAVs), which are aircraft without a pilot, crew, or passengers on board, include drones in their classification. A UAV is a part of an unmanned aerial vehicle, which also includes the addition of a controller on the ground and a communications network with the UAV. UAVs can range in autonomy from fully autonomous aircraft that don't accept human input to autopilot help. Human operators can control UAVs remotely.

Powered, aerial vehicles without human operators that may fly autonomously or under remote control, carry lethal or nonlethal payloads, and use aerodynamic forces to create vehicle lift" are how unmanned aerial vehicles (UAVs) are defined. In relation to military uses, the term "UAV" is frequently employed. However, because the missile itself is a weapon, missiles carrying warheads are not regarded as unmanned aerial vehicles. Uncertainty surrounds the connection between UAVs and remote-controlled model aircraft; such aircraft may or may not be included in UAVs. Although the US FAA considers every unmanned flying object, regardless of size, as a UAV, some jurisdictions base their classification on weight or size. In this situation, UAV is being used to find forest fires. Forests play a significant role in keeping nature in balance. Two-thirds of all terrestrial species on Earth are found in the woods, which make up around a third of the planet's surface. The woods of Earth contribute to its biodiversity. Unfortunately, every year forest fires burn millions of hectares of land, costing hundreds of millions of dollars to put them. It can be difficult to stop unchecked flames from spreading to areas that harm both human life and the natural system of the forests, even while wildfires aid in the establishment of new forests.

A forest fire has grown to be a serious natural menace. Forest fires must therefore be stopped before they even begin. This issue has been the subject of investigation for many years. Numerous solutions have been developed to address this problem. One strategy for reducing forest fires is the development of early fire detection devices in the forest. Massive efforts have been made to keep track of, find, and rapidly put out the fire before it grows out of control. Humans are continuously monitoring the woodlands as part of traditional fire monitoring and detection procedures. But this approach is expensive and unsafe for use on people.

In recent years, remote sensing technologies have emerged as one of the most efficient ways to monitor forests. Computer-based remote sensing systems for the identification and monitoring of forest fires have been made possible by advancements in electronics, computer science, and digital camera technology.

Forest fire monitoring and detection can be done using three different types of remote sensing systems: manned aircraft, satellite-based, and ground-based. However, each of these systems has a unique set of technological issues and norms. The coverage of ground measurement equipment is very constrained. For many hotspots, satellite approaches



are less successful. Man-powered aircraft are typically expensive and big. The safety of the pilots must also be taken into account. The use of unmanned aerial vehicles (UAVs) with computer-based remote sensing systems is become more alluring and beneficial.

UAVs are faster and more mobile, and they also cost far less to continuously detect and identify forest fires. UAVs and remote sensing techniques could enhance currently used techniques. Additionally, UAVs can operate in dangerous regions that are challenging for people to access. These reasons have made UAVs one of the options for fighting forest fires that are currently capturing the attention of the world.

The United States Forest Services (USFS) Forest Fire Laboratory was the organization that first created the UAV system for spotting forest fires (Wilson and Davis 1988). The Wildfire Research and Applications Partnership (WRAP) initiative, which attempts to develop neglected forest fire applications, was also created by the USRP and the National Aeronautics and Space Administration (NASA). The West Virginia Department of Forestry helped a team of researchers from the University of Cincinnati evaluate the UAV Marcus "Zephyr" system's capacity to identify forest fires (WVDF).

II. LITERATURE SURVEY

This section explores the characteristics of functional drones, with special emphasis on their control and the level of autonomy from their controller, in order to construct an adequate working definition for a drone [1].

A better cryptography framework has been developed for small aerial drones, which has a number of energy and speed improvements over traditional cryptographic methods [2].

The key security, privacy, and safety concerns relating to the usage of civilian drones in the national airspace are surveyed in this article. They concentrate on the security demands placed on such systems by their essential operational environment and classify both physical and digital threats to them. [3-10].

The security and integrity of both command data sent by the ground station and payload data delivered by the drone are ensured using a simple piece of hardware. [4].

They are putting forth a novel method of fire detection that can be built into a small-sized UAV by fusing an ANN classifier with the texture and color attributes of flame and smoke from aerial static images. [5].

The strategies discussed in the study aim to improve the accuracy of fire localization and reduce the uncertainty in fire detection by combining the data from many UAVs [6].

They discuss a novel strategy for fire detection and control in this research that makes advantage of contemporary technologies. They specifically suggest a platform that makes use of unmanned aerial vehicles (UAVs), which continuously patrol over locations that might be threatened by fire. [7].

III. METHODOLOGY

The BLDC motor is a motor without brushes and a commutator. It lessens friction. Synchronous motors, commonly known as BLDC motors, employ Direct Current electricity to drive each phase while an inverter or switching power source generates Alternating Current. The driver, such as an ESC, is used to control the frequency and number of current pulses applied to the motor windings in order to regulate the motor's speed and torque. The following ratios are applicable for the synchronous motor that the BLDC motor speed resembles:



$$N=60f/P$$

$$\omega=2\pi f/p$$

N=Motor speed in RPM.

ω =Motor speed in rad/s;

f=frequency of current pulses to the winding,

P=number of pole pairs

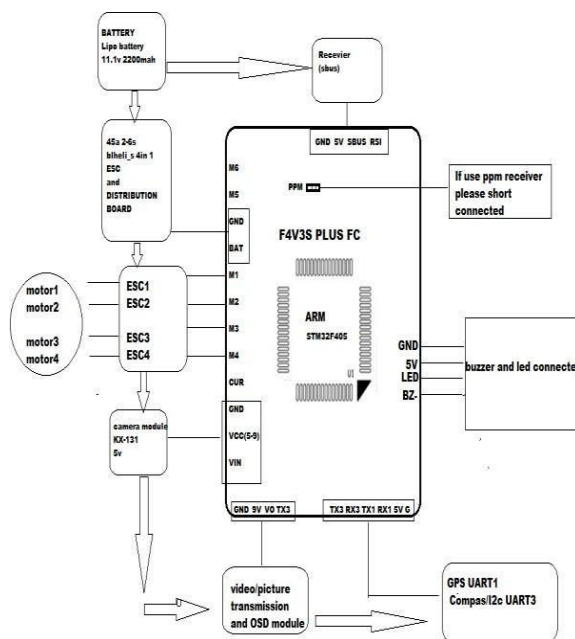


Figure 1 Block Diagram for OMNIBUS F4 V3S Plus

IV. EXISTING SYSTEM

3.1.1 Motor, Compatible Motor Drivers and Propellers

A motor's KV rating or value determines how quickly it will turn for a specific voltage. For the majority of multirotor aircraft, a low KV is preferred (for instance, between 500 and 1000), as this aids in stability. However, for acrobatic flight, we are considering a KV between 1000 and 1500 as well as the use of propellers with a smaller diameter. If a specific motor has a KV rating of 650 rpm/V, it will rotate at 7215 rpm at 11.1V (11.1V x 650). The motor will be run at a lower voltage (let's say 7.4V), resulting in a speed of 7.4V x 650rpm/V = 4810rpm.

Some manufacturers of brushless motors indicate the motor's thrust in relation to various propeller selections (often presented in a table). Kg, Lbs, or N are frequently used as the unit of push. A quadcopter's specific motor, for instance, can provide up to 0.5 kg of thrust with an 11-inch propeller; therefore, four of these motors (with the specified prop) can lift 0.5 kg*4 = 2 kg when operating at full thrust. As a result, our quadcopter will only take off at maximum thrust if it weighs just under 2 kg. We have selected a motor and propeller set that will increase thrust or lighten the aircraft.

Our entire helicopter should weigh no more than around half this amount if the propulsion system (all engines and props combined) can produce 2Kg of thrust (maximum) (1Kg, including the weight of the motors themselves). For our configuration, the identical computation is made. Let's say that a quadcopter weighs 2.5 kg, including the frame, motors, electronics, batteries, and other accessories. The capacity of each motor should thus be (2.5Kg/4 motors) times 2:1 = 1.25kg of thrust (or more).

3.1.2 Battery

Chemistry-

Nowadays, Lithium polymer (LiPo) batteries are the most common type of battery used in UAVs, with Lithium-Manganese or other Lithium variations being some of the more unusual ones. NiMh / NiCd batteries are still too heavy for their capacity and frequently unable to achieve the high discharge rates required, while lead acid is simply not an option. LiPo batteries have high discharge rates, low weight, and high capacity. The drawbacks include their considerably greater price and ongoing safety concerns.

Voltage-

For your UAV, you should only need to think about one battery pack. The motors you selected should work with the voltage of this battery. These days, almost all batteries are lithium-based and comprise several 3.7V cells, where $3.7V = 1S$. A battery that is designated as 4S is therefore probably $4 \times 3.7V = 14.8V$ nominal. However, knowing the amount of cells will enable you to choose the appropriate charger. Physically, a single cell high-capacity battery may resemble a multi-cell low-capacity battery quite a bit.

Capacity-

The capacity of a battery pack is expressed in amp- hours (Ah). Battery packs for small drones can be as low as 0.1Ah (100mAh), whereas medium-sized drone battery packs are 2-3Ah (2000mAh- 3000mAh). The longer the flight time, but the heavier the pack will be, the higher the capacity. A typical UAV's flight length can be expected to be between 10 to 20 minutes. While this may not seem like a long time, keep in mind that the UAV is always fighting gravity and, unlike an aero plane, has no surfaces to aid in lift.

3.1.3 Radio Control

The Fly Sky FS-i6 2.4G 6CH PPM RC Transmitter and FS-IA6B Receiver This 6-channel receiver has a range of more than 500 meters and is compact. It contains a twin antenna, which enhances reception and effectively blocks interference.

The receiver remembers the transmitter's unique ID while they are bound and only accepts data from that transmitter because each transmitter has a unique ID. As a result, it is impossible to identify additional transmitter signals, inference is greatly diminished, and safety is increased.

3.1.4 Belheli 4 in 1 ESC

BLS U 35A V2.1 2-6S 4-in-1 electronic stability control system for small cyclone separator. BLHELI_ S 35A V2.14 in 1 small electronic stability control, just designed High system integration, size reduction compared to the norm, high performance, and 6S support. J-H-30 is the goal. Encourage the use of DSHOT, MULTISHOT, ONESHOT, etc. The pad is robust and only partially extended, saving space.

An electrical circuit known as an electronic speed control, or ESC, manages and regulates the speed of an electric motor. It might also offer dynamic braking and motor reversing.

3.1.5 Flight Control Board (OMNIBUS F4 V3S Plus)

Due to the complete lack of documentation on all of these F4 V3S plus boards. We make an effort to write our own material for comprehension.

Specification:

1. Item name: F4 V3 PLUS Flight Controller.
2. Size: 36x36mm.
3. Mounting holes: 30.5x30.5mm.
4. STM32 F405 MCU.



5. Dshot support.
6. Drag and Drop OSD configured via Beta flight.
7. Gyro: BMI270.
8. SBUS / PPM AND Spectrum DSMX ports.
9. Micro SD card black box.
10. Baro (BMP280).
11. BEC: 5v3a 9V3A On-board video filters (only 5V to VTX).

IV. CONCLUSION

An overview of several UAV fire assistance system creation techniques is given in this paper. There have been discussions of various coordination methods, sensing technologies, and fire perception algorithms. UAVs can be quite useful in the fight against wildland fires in large areas. As their prices come down and their commercial availability grows, new uses for them will emerge. There are still some limitations, such as those pertaining to autonomy, dependability, and fault tolerance. More research is needed to overcome these limitations. Another concern is security because it could be dangerous to have UAVs hover over firefighters or close to aircraft bringing water and fire retardants. However, deploying UAVs provides a number of benefits that may encourage the development of solutions to these problems. The majority of perception methods currently in use rely on standard computer vision algorithms. Though it is still in its infancy, some work in the subject of deep learning has emerged in recent years, particularly for fire detection. A few datasets that included images of wildland fires were also presented. The development of computer vision algorithms can make use of these resources. Unfortunately, only few

of them have aerial photos of wildfires. Furthermore, the absence of a sizable dataset restricts the development of complex deep learning algorithms.

Because they may be used to benchmark tactics and objectively compare them, such datasets would be essential for the field's future.

This work also investigated frameworks for cooperative autonomous systems where ground and air vehicles work together to fight wildfires. These frameworks provide intriguing ideas for a wildland firefighting system that is more complete, albeit being essentially theoretical and limited to simulations. Future research in these areas might generate novel suggestions for advancing the creation of autonomous operating systems with little to no human input.

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Impact Factor: 8.118



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