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CROP MONITORING BY DRONE

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Abstract-More than two hundred thousand people enter the planet every day. By 2050, experts predict that the global population will rise to 9.6 billion. It's certain that this will lead to a rise in the need for food, which can be satisfied only by increasing harvest output. As a result, agricultural modernization has emerged as an urgent need. The use of drone technology in agriculture has the potential to address a number of issues that contribute to subpar harvest yields. A drone is a kind of Unmanned Aerial Vehicle (UAV) that may be piloted by a single person using radio control. Drones come in a wide range of sizes and shapes, each optimized for a specific task. The project is to construct a drone that can be stabilized in flight and used to take aerial photographs of a field, which can then be used to detect and assess crop damage. For this project, we combined the GPS tracking capabilities of the drones and the flight controller technology of the devices used to operate them to provide real- time audiovisual input. The operating distance to 2 kilometer (km) and installing cutting-edge features such a camera, screen, LED light, and powerful battery are in the works to boost performance. This finished implementation of the project makes it possible to monitor any region with little to no human intervention and to greatly minimize the amount of time and energy spent on agriculture. Everything from motors to receivers to transmitters to batteries to frames to cameras to screens to propellers is a part of its design.

Keywords: Drone, Crop Monitoring, UAV, GPS.

1. INTRODUCTION

There are significant problems that must be solved by the global agricultural system. During the next four decades, the UN Food and Agricultural Organization (FAO) estimates that food production would need to increase by 70 percent to keep up with growing demand brought on by improving living standards and expanding populations. Agriculture is a major industry in India and a major source of wealth. Almost 60% of the workforce in India is involved in agriculture. It's crucial to the success of the Indian economy. To raise agricultural output and efficiency, providing secure cultivation conditions for farmers is crucial. In a 2018 survey, researchers found that 9.2% of the global population had severe difficulties securing enough nutrition. Continuing to reduce food supplies will lead to a desperate situation. The food insecurity issue was moderate, affecting up to 17.2% of the population who did not have reliable access to enough food. Around 26.4% of the entire population is affected by the combination of a moderate and severe food availability issue. Food distribution systems and crop production were hit hard by the COVID-19 epidemic. Several farmers were hampered by the untimely delivery of essential agricultural inputs such as labor, seeds, fertilizers, and pesticides, leading to lower yields.

Many Asian countries are still in their developmental stages, and thus must deal with the problem of a large population while also having significantly poorer agricultural efficiency than technologically sophisticated nations. A same problem is affecting India. This is because to the region's dated farming equipment, inadequate electricity, experienced farmers, and other factors. Aerial remote sensing is one of the most crucial technologies for modern agricultural methods like smart farming and Precision Agriculture (PA). Drones are used for aerial remote sensing, which analyses photos captured at various wavelengths and calculates vegetation indices to identify a wide range of agricultural conditions. Historically, required photographs used in precision agriculture were captured through manned aero-planes or satellites. The use of manned aircraft for picture capture is too expensive, and the difficulty with satellite photos is that they often lack the detail needed for accurate analysis.

The spatial resolution is usually not up to snuff. Also, the accessibility and quality of photos are affected by the weather.

Due to improvements in Unmanned Aerial Vehicle (UAV) technology and the lower weight of payload devices, remote sensing of crops has turned in this direction. This technique is more efficient, saves money, and can take high-resolution pictures without damaging anything. Unmanned Aerial Vehicle (UAV), Miniature Pilotless Aircraft, and Flying Tiny Robots were some of the early titles given to this instrument of the military. Businesses, government agencies, farms, security services, insurance companies, mines, movie studios, radio stations, cable companies, transportation companies, and so on are just some of the industries now making use of it. Substantial potential exists for the drone's market. Given the breadth of drone use cases, it's not surprising that the technology behind drones has rapidly advanced, making them more accessible. Applications of tiny unmanned aerial vehicles (UAVs) are expanding rapidly in the agricultural industry at present.

Drones now operate at a semi-automated level but are rapidly progressing towards completely autonomous ones. These gadgets offer a large potential for agricultural planning and associated spatial information collecting. Not with standing its limitations, this technology has the potential to be used in effective data analysis. Once radio-controlled by a pilot on the ground, today's unmanned aerial vehicles (drones) are GPS-based autopilot aircraft. Applications determine the drone's camera, sensor, and control needs. Dive technology relies on miniaturized sensors whose performance—accelerometers, magnetometers, gyros, pressure sensors, etc.—is steadily improving as their size shrinks.

Improved processing power, GPS modules, and digital radios with greater range are all contributing factors to the rapid evolution of drone technology. With the development of cutting-edge embedded electronics and motors, UAVs have become smaller and more powerful while simultaneously increasing their cargo capacity. As a result, the drone can be controlled more precisely and used for field monitoring in more inaccessible locations. The world's population is expected to expand from its current seven billion to nearly nine billion by 2050, making food production the primary problem facing the agricultural sector worldwide. As compared to this, India's population is expected to grow from its present 1.34 billion to 1.51 billion by 2030, and then to 1.66 billion by 2050. Indicia is defined by its subsistence farmers. So, drones, as cutting-edge technologies, may be the answer for farming to lessen the burden of labor and to report a large quantity of data for study in a short period of time, making it simpler to usher in agricultural sustainability in the future.

1.1 PROBLEM STATEMENT

As the population is growing so quickly, ensuring everyone has enough to eat is becoming more difficult task. By 2050, global food production will need to expand by around 50% if we're going to be able to feed a population of a billion people. Around two-thirds of the Indian population relies on agriculture for their livelihood. When it comes to crop monitoring and other agricultural practices, Indian farmers rely on time-tested methods. Traditional crop monitoring and fertilizer spraying methods are more time-consuming and inefficient. For instance, the COVID-19 outbreak made it incredibly difficult for traditional farmers. For this reason, innovation in this area of technology is essential.

1.2 OBJECTIVE

The purpose of this implementation is to construct a stabilized drone capable of taking photographs in the field that can be used for examining the damaged or decaying crops, as well as providing information on the various phases of crop health and the general development of the crops. The technology of drone is an effective method for overcoming these challenges in agriculture. Specialists in rural areas and farmers may be able to enhance their practices by using data obtained by drones to raise crop production. Aerial remote sensing is one of the most critical technologies for precision agriculture and smart farming. Monitoring systems that use drones are useful to farmers for taking bird's-eye views of their crops before harvest. The photos of the crops taken by the drone may provide vital statistics on the condition of the crops. These photos may be analyzed to extract various traits that provide information about plant health that is not immediately apparent to the human eye. The capacity to frequently check yield is another key characteristic of this technology. Access to agricultural data on a regular basis empowers farmers to make informed decisions that improve crop management.

2. LITERATURE REVIEW

In 2012, Jacopo Primicerio et al. built a drone they call VIPtero. Site-specific vineyard management benefited from this. It was a self-flying hexa-copter equipped with a multispectral camera that could be used in certain locations. The "VIP-tero" platform was meant to be efficient and cost-effective while still being ecologically friendly. It performed the required work with a high level of competence and precision. Yet, sensor downsizing and enhancement of the system's payload capacity were also necessary.[1]

P. P. Mone et al published a paper entitled "Agriculture Drone for Spraying fertilizer and Pesticides". This paper explains how to use an agricultural drone with an autonomous spraying system. They presented the World Health Organization's issue statement, which states that annually, particularly in poor countries, there are 3 million instances of pesticide poisoning and up to 2,20,000 fatalities.[2]

In 2015, Hassan- Esfahani et al. presented an agricultural use of remote sensing technology they called "AggieAir." It could take pictures in the visible, infrared, and thermal spectrums as well as the more common RGB (Red Green Blue). It gave us access to high-resolution multispectral imagery for checking up on crops.[3]

In 2016, Santesteban et al. used a drone-based method to assess plant water content in vineyards. The crop's current and future water needs were estimated using drone-captured thermal pictures. In order to assess crop health, the Crop Water Stress Index was used (CWSI).[4]

In 2017, Paredes et al. developed a basic multispectral imaging system for use in agricultural UAV projects. In order to capture multispectral pictures, a lower-order system was devised that makes use of a number of cameras. The data acquisition and flight controller systems coordinated well.[5]

Royo -Vela and Black, 2018; Stankov et al., 2019) - Pictures used in ads Drones are increasingly being used for business purposes, such as at sports events or in marketing campaigns, but they are also increasingly being used for personal purposes, such as the documenting of a person's unique occasion.[6]

In 2019, K Anand et.al created a flying machine they called Aero-Drone; it monitors fields and sprays them with chemicals. Reduce spraying duration and waste of insecticide was the goal. It was suggested that the mission be delegated in the field using a simulation platform, and that this plan's sensitivity and accuracy could be tested in the process. The results showed that the job done by this integrated system of quad-copters was efficient, and the flight times of each quadcopter were quite similar. This plan worked well, although the tests were limited to a square acre of farmland.[7]

In 2020, Su et al. have suggested utilizing UAV to automatically track the spread of the yellow rust illness. A multispectral camera has been employed for the data collecting. It recorded the five distinct spectrum bands which are RGB, additional Red Edge, and NIR. The suggested approach depended on U-Net for semantic segmentation. The use of a wider range of bands resulted in better image segmentation results.[8]

3. PROPOSED WORK

STEP-1

The FC should be attached to the frame such that the LCD is visible from the front and the buttons are accessible from the rear. The anti-static foam cover provided may be used to safeguard the aircraft's Flight Controller.

STEP-2

Join the controller's left side to the signals sent out by the receiver. Observing the pinout, the colors should read from left to right as black, red, and orange. This is because the negative (black or brown) should be connected to the pin closest to the board's edge. Connected from the board's face forward to its push buttons are a set of channels.

STEP-3

Assemble the ESCs by plugging them into the correct port on the Flight Controller Board. M1 is located in front of the board, while M4 is closest to the controls. The black and brown minus signs point towards the outside border of the flight control board. Connect the black or brown negative lead to the outermost edge of the Flight Controller. For safety reasons, propeller installation should wait till later. An electronic speed controller (ESC), either the ESC for one of the motors or a separate device supplying the receiver, must be connected always to the +V line on the flight controller board. If both ESCs have a built-in BEC (which is standard unless you have an OPTO type), you may need to disconnect the power from one of them. This is often done by cutting the power line (RED) wire on the second ESC.

STEP-4

Install the model on the transmitter using a standard aircraft profile, then attach the receiver to the transmitter.

STEP-5

After powering on and pressing the "Menu" button, go to the "Receiver Test" sub-menu by using the "Up" and "Down" arrows, and then click the "Enter" button. Now, you should go through each channel on your transmitter and double-check that the direction indicated matches the stick movements on the Flight Controller. If any channels are backwards, you should switch them around on your transmitter. When you turn on your transmitter's AUX Switch, make sure the AUX channel displays "ON"; if it doesn't, switch the AUX channel around. Zero out the channel values on the LCD display by using the trim or sub-trim settings on your transmitter.

STEP-6

On the submenu that appears, choose "Load Motor Layout" and then make your selection. Use the "Mixer Editor" option if the desired setup is not available. For more information on this, please check back later.

STEP-7

To verify the following, choose the "Show Motor Layout" menu item. Put in the settings for an x-model drone.

STEP-8

Switch your transmitter sticks around to make sure they're all working, and make sure to use the "receiver test" button to make sure AUX1 is functioning properly.

STEP-9

In order to change the gain settings, go to the "PI Editor" submenu and examine the PI gain values there. To alter both Roll and Pitch simultaneously, go to the "mode setting" submenu, use the PREV and NEXT buttons to choose the parameter to change, and then hit change. You may now install the propeller and put the flight control board through its paces by holding the craft in the Arm position with the right Rudder and no throttle for a few seconds; if everything is working as it should, the board will beep and the RED LED will light up. After landing, keep the rudder to the left at zero throttle; a beep will sound, and the RED LED will turn out, signaling that the drone is in safe mode and that you should not approach it until you have armed it. If the ship begins to list dangerously, inspect the connections and, if you have one, the mixing table you built yourself. After takeoff, modify the Roll and Pitch P-gain down if it sways and rises, or up if it topples over easily. If it starts to stray, just use the trims to rein it in. If the wind is blowing, it will float. Make sure the motors and arms are at the right angles and in excellent working order if you find yourself in need of extensive trimming. When the aircraft gains altitude, increase the Roll and Pitch I gain (different from P gain) until it travels in a straight line. By holding right aileron, you may activate or deactivate the self-leveling feature. Just hold left aileron to disable it. You may also use the AUX channel if you choose. Observe the examples below Details on the many sub-menus.

STEP-10

To examine and modify these parameters, go to "Mode Settings." "Self-Level "Sets whether the self-leveling feature is operated by the STICK or the AUX Channel. Self-Leveling may be activated in "STICK MODE" by holding the aileron to the right through the arming and disarming processes. To disable, use the left aileron. Self-leveling may be activated or deactivated through the AUX Channel. If the Flight Control board is inactive for 10 minutes, the " Auto Disarm " setting will activate. Permitting CPPM "Figure out whether the Flight Control Board will take CPPM data as input.

STEP-11

To customize the stick's reaction to your play style, choose "Stick Scaling." A greater reaction may be expected for larger numbers, whereas smaller ones will have the opposite effect. You can change the stick response by adjusting the endpoint or loudness on your transmitter, and you can change the amount of Reaction from stick inputs by using the stick scaling. When the throttle stick on the Transmitter is set to its lowest position, the motors should continue to operate without interruption. This setting is found under "Miscellaneous Settings." This feature, known as "Height Dampening," makes use of the Z accelerometer to counteract vertical motions brought on by the wind or by angling the craft. The number 30 is suggested as an optimal setting. Set the "Height D. Limit" control to avoid overcontrolling the height damping and therefore wasting the available power. The default level is 10%, which is too low. Changes the battery voltage threshold at which an alert is triggered. When the value is 0 (zero), the alarm will not go off. Make the necessary adjustments based on the current battery status as reported by the Flight Control Board's sensor input. An alarm will ring when the supply voltage reaches 10.8 volts, so if your battery is a regular 3-cell LiPo, use a value of 3.60 volts per cell to indicate an empty battery, and then set this value (in 1/10s) to (3.6 x 3 * 10) = 108. Remember that the alarm will go off if you set this value to anything more than zero and there is no battery connected or being monitored. The duration between pulses increases as the alarm voltage approaches the set point and decreases as the alarm voltage reaches the set point. To begin, try a value of 50 for the "Servo Filter," a Low-Pass Filter that allows you to disregard channel vibrations (ms). If channel jitters are occurring, raise this number; otherwise, leave it at 0. (zero).

With "Sensor Test," you can see how your sensors are performing. Test to see whether everything is in the "good" zone. Just repositioning the FC will cause a shift in the results.

"ACC Calibration": Calibrate the Acceleration Sensors by following the on-screen directions once during setup.

The time has come for the ESCs to be calibrated. Starting with the throttle at minimum and working our way up to full while holding down the S1 and S4 switches, we next connect the batteries to the quad copter, hear two beeps, and then settle on a single beep when we reduce the throttle. This completes the calibration procedure. When ready to fly, maintain the throttle on the left. Arming the quadcopters is a two-step process.

The camera on the drone is turned on and ready to begin live streaming and taking photographs as soon as the battery (Lithium polymer) is inserted into the power distribution board. In order to prevent an ERROR in the FCB, the Transmitter must be in the ON position first. After the FCB and transmitter are turned on, the receiver is tested by setting all channels to "0," whether they're for the ailerons, throttle, elevator, rudder, or aux. Now that you've finished the receiver test, you may ARM the K.K 2.1.5 board to have all four motors spin in the same direction and at the same pace. Raise the Throttle on the Controller to keep the engine spinning steadily, and you're ready to take off.

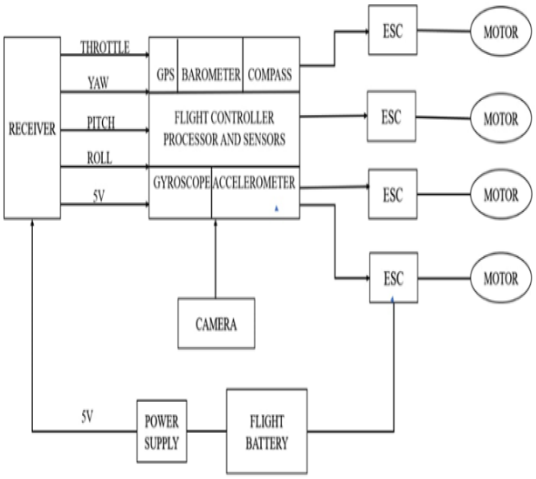

Fig1: Block Diagram of Proposed Model

4. RESULTS

The drone which is implemented specifically for agriculture has the potential to provide better harvests. The usage of drones in agriculture by farmers has the potential to revolutionize the sector. There is a plethora of unmanned aerial platforms used in farming all around the world. Most of them are little drones fitted with specialized cameras for keeping an eye on farms. In this project, drones are used to take pictures of plants in fields, making it easier to check for things like rot or damage, which ultimately leads to better crop yields.

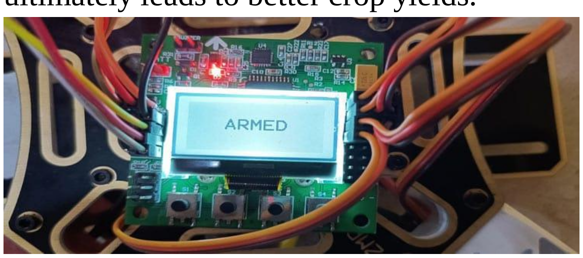

Fig2: Armed

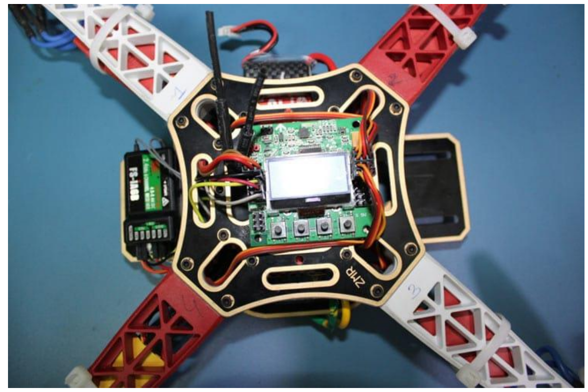

Fig3: Fly Drone

Fig4: Drone

Fig5: Crop Monitoring of drone

5. CONCLUSION

We learned everything from the definition of unmanned aerial vehicles (UAVs) to the inner workings of each kind of UAV now on the market to the reasons why drones are so important right now and where the industry is headed. What kinds of improvements are needed in the current drone, and how to make drones for performing well in operations that would be difficult or dangerous for humans to carry out on their own, such as data collection from remote locations, are all topics that could benefit from further exploration. In this study, we detail the design of an unmanned aerial vehicle (UAV) that may be used in a control loop for agricultural applications, in which UAVs are tasked with monitoring both agricultural areas and the surrounding environment. Yet UAVs will play a significant role in the future development of precision agriculture. Significant cost reductions (up to 90%) in the areas of water use, chemical waste, and human labor are anticipated. The majority of agricultural UAV applications involve low-altitude, low-weight flights over deserted or privately owned land, therefore compliance with flight restrictions is a concern.

FUTURE SCOPE

The ability of quad-copters to lift weight may be improved by increasing either the motors number powering the aircraft or the size of the propellers being used. The battery capacity determines the amount of time the aircraft can stay in the air. The duration of a charge is a variable. When many sensors are combined, the output is enhanced. DIP methods may be used to identify dead crops and separate them from healthy ones.

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