SKY SEED SPREADING SYSTEM (S4)

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Abstract- The forest is disappearing at an alarming rate. India is losing about 1.5 million hectares of forest area each year. Keeping the problem in mind we have come up with a solution that is Sky Seed Spreading System (S4). Our **Objective** is to build a Hexacopter which is capable of spreading seed in deforested areas. The working includes three components, a custom-build hexacopter, an Arduino-controlled seed spreader and software that generates GPS co-ordinates for mission trajectory, A soil sensing device is used to achieve soil parameters like the soil pH value, soil moisture and temperature of the soil. Then the noted values are cross verified with the threshold values. If the noted value crosses the threshold value then the area is included in the trajectory otherwise it is not. The flight trajectory is plotted using a software called Mission Planner. S4 is different from other projects as the seed spreader is made by reused cardboards making it cost efficient and effective, can contain 3-5 Kg of seeds and can also disperse a bulk quantity of seeds in a single charge.

Keywords— Deforestation, Seed spreader, Soil sensor, Hexacopter/Drone).

I. INTRODUCTION

As it is assumed that the world is responsible to slow the pace of climate change, preserve wildlife, and support billions of people, trees inevitably hold a major part of the answer. About 30 percent of the world's land area are still covered by forest, but they are disappearing at an alarming rate. According to the World Bank—an area larger than South Africa that is about 502000 square miles (1.3 million square kilometres) of forest were lost between 1990 to 2016.

About 1.5 million hectares of forest is lost in India each year. Nearly 1 per cent of the land surface of India is turning barren year due to deforestation. In the Himalayan range, the rainfall has declined 3 to 4 per cent due to deforestation. According to the figures of the forest department in the first four months of the 2014-15 financial year around 61,009 trees were cut.

Mentioning the above statistics, we came **across the idea** of Sky Seed Spreading System (S4). The purpose of this project is to build a motor controlled autonomous flying vehicle (Hexacopter) which is capable of spreading seed in deforested areas and agriculture land with the potential for reforestation.

The **working** of the project includes three components, a custom-build hexacopter, an Arduino-controlled seed spreader and software or app that can generate GPS co-ordinates for mission trajectory, controlling the seed spreader and to communicate with the operators.

The **Hexacopter** is built using a frame for a multirotor, where all the structure of the Drone is mounted. This hexacopter is powered by a battery connected to a power module responsible for distributing the power to the six output channels. The output connections provide five volts each, and they are connected to four ESCs, all connected to the six motors. The Autopilot Flight Control Board acts as the central unit that receives the commands and uses a GPS system for navigation. The ground station uses a telemetry radio system over the MavLink protocol to get the information from the Autopilot (pixhawk 2.4.8) Flight Control Board.

The Main Hardware components are used to build this hexacopter are listed below: -

1. Airframe: - F550
2. BLDC motor: - 920kv (CW & CCW)
3. ESC: - 30A
4. PMU (power module unit)
5. Flight Controller: - Pixhawk 2.4.8
6. Radio System: - Fly sky 10 channel TX & RX
7. Telemetry Kit: - 433Mhz Air & Ground module
8. Propellers: - 10*45 (CW & CCW)

Figure 1: - HEXACOPTER

1.1 BLDC

The brushless motors (BLDC) are multi-phased, normally 3 phases, so direct supply of DC power will not turn the motors on. BLDC electric motor also known as electronically commutated motors.

1.2 ESC (Electronic Speed Controller)

ESC generates controllable three different high frequency signals phases to keep the motor turning. The ESC sources a lot of current as the motors can draw a lot of power. ECS's are required to run the BLDC motors in the Hexacopter. The ESC is directly connected to the receiver's control channels and then coupled with the BLDC motor.

1.3 Flight Controller (Pixhawk 2.4.8)

A flight controller (FC) is a small circuit board with huge complexity. Its function is to rotate the motor and maintain the RPM of each motor in response to input. A command from the pilot for the multi-rotor to move forward is fed into the flight controller, in our case we are using Pixhawk 2.4.8 which is good, efficient and low in cost.

1.4 Radio Telemetry Kit

These 433 MHz PixHawk / Ardupilot telemetry kits allow you to establish a telemetry connection between your drone and computer as well with your mobile. The Radio telemetry system for ArduPilot, is designed as an open source, offering a lower price, longer range and superior performance to Xbee radios.

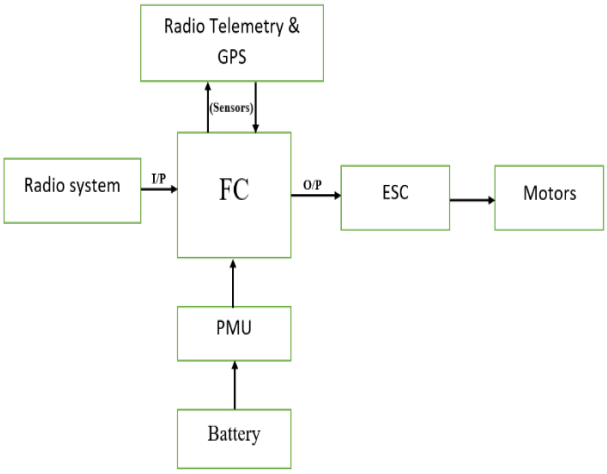

Figure 2: - BLOCK DIAGRAM OF HEXACOPTER

1.5 Seed Spreader

The seed Spreader mechanism's main role is to release the seeds on the selected site. The seed-releasing course is controlled by a BLDC motor, connected to an Arduino and 12v power supply. Seeds are dropped on the rotating disc which is connected to a BLDC motor, opening and closing of latch is controlled by servo motor which is controlled via Transmitter (remote).

The agricultural industry seems to have accepted the drone technology with open arms, using these advanced tools to transform modern farming. High-tech drones will allow farmers and the drone pilots that operate them, to increase efficiency in certain aspects of the farming process. From crop monitoring to planting, crop spraying, 3D mapping, and more. Agricultural drones help to achieve decrement of labour work and improve what's known as precision agriculture.

II. Related Work

Due to their versatility and cost effectiveness, drones are becoming strong allies in fighting against environmental issues and controversies such as crop inspection, forest fire and survey work for the inspection of flood defenses Based on these facts, companies, profit and non-profit institutions, and singular entities are trying to develop projects that can take on the responsibilities and benefits that the UAVs have to offer. Ambitiously, this may significantly impact a change on the disputes and misconceptions on climate change.

III. Proposed Methodology

The simple explanation of the functions in S4 can be clearly explained using the block diagram which is given in figure 5.

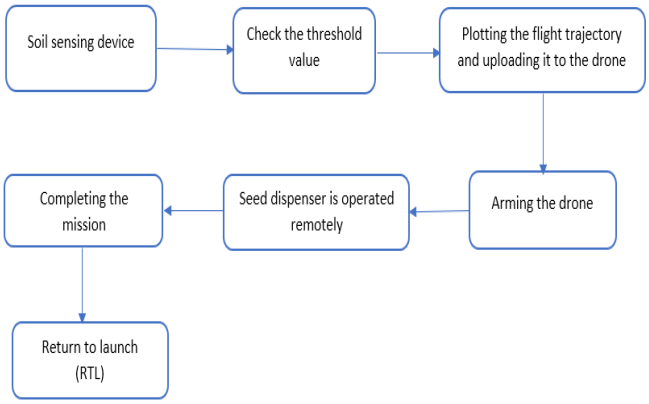

Figure 5: - BLOCK DIAGRAM OF S4

As seen in the figure 5, first a soil sensing device is used to measure the soil pH value, soil moisture and temperature of the soil which will be noted down or will be recorded. After that, the noted values will be cross verified with the threshold values that are the values less than or greater than them. If the values are less than the threshold value than that part of the field will not be included in mapping process and if the noted values are greater than the threshold values then that part of the field will be included in the mapping process. After this step the flight trajectory of the hexacopter is plotted using a software called Qground controller which is used for mapping the drones

in the assigned areas. Next, the drone is armed and is given command to start by arming it. For convenient spreading the spreading system is controlled manually by the user. After the completion of the mission the drone returns back to the way point from where it was started which is called RTL mode (Return to Launch mode). The flowchart of the S4 is shown in figure 6.

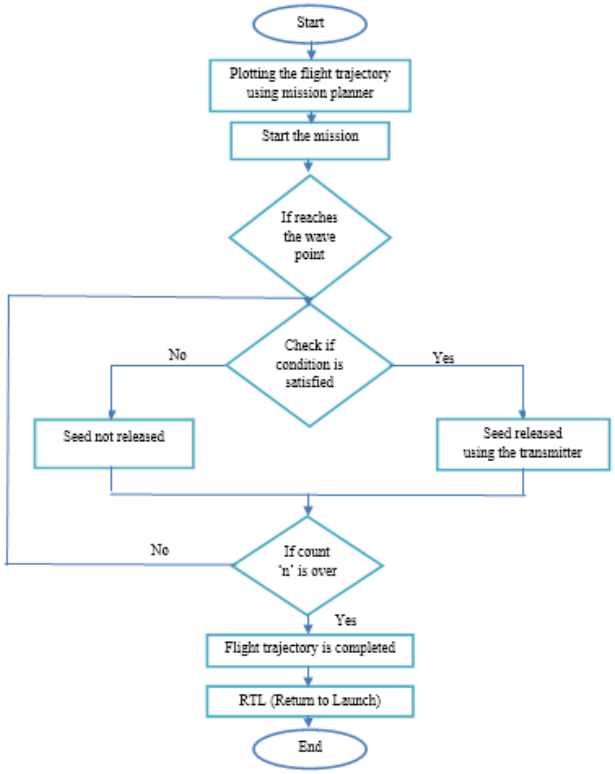

Figure 6: - FLOWCHART OF S4

3.1 Software

3.1.1 Mission Planner

Mission Planner software will only supports ArduPilot Flight Control boards, it is a full-featured ground station application and a open source software. This community-supported application was developed by Michael Oborne.

The ArduPilot software suite consists of navigation software running on the vehicle (either Copter, Plane, Rover, Antenna Tracker, or Sub), along with ground station controlling software including Mission Planner, APM Planner, QGroundControl, MavProxy, Tower and others.

This free software designed for mission planning on Unmanned Aerial Vehicles (UAV) includes the following features [mission planner help]:

• Flight Data – It is a Primary flying screen with location and attitude

• Flight Planner - Plans your flight and other scripted actions

• Configuration - Customizes the PIDS and other critical settings, including enabling and disabling hardware.

• Firmware - Updates your APM Firmware with the latest stable built-in and sets up your new Ardu-Plane/ArduCopter/ArduRover.

• Terminal - Manual set up of your APM/PIXHAWK that runs tests on sensors, log readings, and other functions.

FIGURE 7 - Mission Planner (Mandatory set-up)

FIGURE 8: - Mission Way Points

3.1.2 Seed Control

The seed control code is used for controlling the acceleration of the BLDC motor which is connected to spreading system and opening and closing of latch will be controlled via remote or transmitter.

```
#include <Servo.h>

Servo esc_signal;

void setup()

{
```

```
 esc_signal.attach(12);

 esc_signal.write(30);

 delay(3000);
}

void loop()

{
esc_signal.write(55);

delay(15);

}
```

IV. Results

Figure 10: - SKY SEED SPREADING SYSTEM

Figure 11: - LEFT SIDE VIEW OF SEED SPREADER

Figure 12: - RIGHT SIDE VIEW OF SEED SPREADER

The above figure shown are the final outputs of our project.

V. CONCLUSION

We understand that there is a rapid growth of technology in the agricultural field and our Project is one such source that aims for reforestation. In this project we have discussed about working of Hexacopter (drone) and seed spreader and also their pros, cons, limitations etc... By implementing this project in the field of agriculture we can help farmers in the initial stage of agriculture. Our project (Hexacopter) is designed to facilitate the farmers to ease their work and increase the productivity with its working features such as it is more efficient, doesn't require any kind of man power since our Hexacopter (drone) is autonomous, there is no wastage of seeds and also it help in afforestation.

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