International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 04 | Apr 2021 www.irjet.net p-ISSN: 2395-0072

Weather modification Drone (Cloud seeding)

Prof.Asha Sanap[1], Prof. Neha Dutte[2], Rohan Vijapure[3], Viraj Memane[4], Shivam Chavan[5], Soham Malanhorkar[6]

[1,2]*Professor, Electronics and Telecommunication Department, MIT Polytechnic, Pune, India*

[2, 3,4,5]*students, Electronics and Telecommunication Department, MIT Polytechnic, Pune, India*

Abstract: *Water is not abundant on Earth and the consumption of water is increasing substantially worldwide. There should be ways to maintain the demand for water and provide resources. This report discusses a technology that is stated as promising in which it creates precipitation from clouds. This technology is called cloud seeding, and it is a form of weather modification and a technique to increase the amount of precipitation in an area. This paper will define cloud seeding, and how the technology of cloud seeding works. It will discuss the various methods used and under what circumstances a certain method is preferred. Most importantly this paper will provide an understanding of the microphysics of clouds and the atmospheric conditions in which precipitation occurs. How to build and execute the process and Furthermore, how it will tackle water scarcity of an area, the benefits of cloud seeding and how it could improve the economy, the weather, and how it could improve water supply.*

Keywords: PixHawkcube, APM 2.8 flight controller, precipitation, water reservoir, Telemetry kit,

1. INTRODUCTION

Water is the most essential resource for all life on earth. 71% of earth's surface is covered with water but unfortunately fresh water we drink, bath in, and use to irrigate our farm fields is incredibly rare. Only 3% of the world's water is fresh water, and two-thirds of that is tucked away in frozen glaciers or otherwise unavailable for our use. As a result, some 1.1 billion people worldwide lack access to fresh water and a total of 2.7 billion find water scarce for at least one month of the year. In many regions of the world, traditional sources and supplies of ground water, rivers, reservoirs, are either inadequate or under the threat from ever increasing demands on water from changes in land use and growing populations. Only a small part of the available moisture in clouds is transformed into precipitation that reaches the surface. This has prompted scientists and engineers to explore the possibility of augmenting water supplies by means of cloud seeding. By proposed method, we can increase the water supply of an area in very low cost.

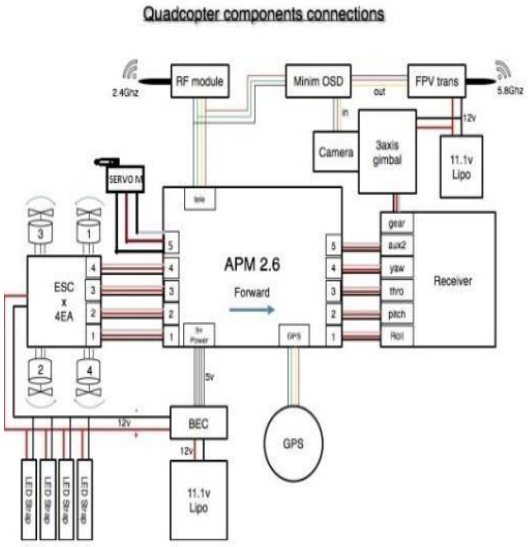

FIGURE 1. Block diagram of Cloud seeding drone

The above diagram shows the pin configuration of APM 2.8 Flight Controller with its output devices.

2. WORKING OF SYSTEM

APM 2.8 is the brain of the drone, whose general purpose is to direct RPMs to each motor or to control other output device like servo motor or camera. We can use telemetry kit to make the process completely autonomous where Servo motor is used to trigger different types of chemical release in the atmosphere. i.e. ignition or ejection method given below.

FIGURE 2.1 DRONE STRUCTURE (Top View)

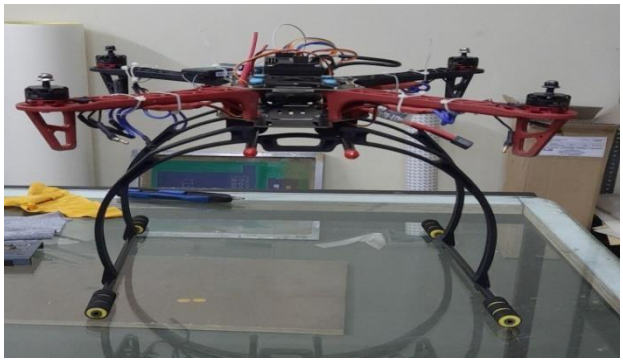

FIGURE 2.2 DRONE STRUCTURE (Front View)

There is two methods for chemical release:

There are two types: 1] Burn in place flare.

2] Eject able flares.

Burn in place flares: These are attached on the aircraft and triggered through ignition. In this type of releases mechanism, the chemical is burned and the smoke is released in the atmosphere. Chemicals like sodium iodide or potassium iodine are used.

FIGURE 2.3Burn in place flare

Eject able flares: Eject able flares are stack of chemical dropped or ejected from aircraft at the designated cloud formation which bursts when ejected dispensing huge amounts of chemicals in atmosphere intended to spread with the assistance of high wind covering more area.

FIGURE 2.4 EJECT ABLE FLARE.

2.1.Procedure:

So for starters first thing you want to do is select a place like water reservoir where rain water could be harvested in abundance, find the right clouds for seeding, monitor the wind, temperature, and direction of the cloud. Run a pre-flight check of the copter, and make sure all the parameters are right. Also check for the modes, channel and switches on the RC controller. After completing the pre-flight check launch the copter towards the target. Using the onboard camera or the telemetry kit to navigate or set a pre-determined flight plan for the copter, we normally use "mission planner software". After reaching the altitude flip the toggle switch i.e. SWD set to channel 6 of the RC. (You can assign the trigger to any of your desired switch on the RC controller, using mission planner set parameter). Channel 6 is connected to a servo motor at the output terminal of APM 2.8 that triggers the ignition of the chemical burning either through the triggering circuit with ignition (Burn in place flares) or dropping mechanism (Eject able flares).

3. DESCPRITION OF COMPONENTS

3.1. APM 2.8 FIGHT CONTROLLER

Flight controller: is the brain of the drone, whose general purpose is to direct RPMs to each motor. APM or PixHawk flight controller provide great platform for project integration, APM has 10 i/o ports in which first 4/6/8 are designated for the (quadcopter/ hexacopter/ octocopter) depending on the design of the drone. It has inbuilt GPS and pins for external GPS as an upgrade which offers various modes like altitude hold loiter mode, etc. It also supports telemetry kit which can be connected to your phone or laptop giving you real time data of your drone. We can assign the i/o port 9 and 10 for Servo motor and camera respectively to trigger release of the chemicals. Refer Figure 1.

Sensor: 3-Axis Gyroscope, Accelerometer, high performance Barometer, and many more.

Supported protocols: I2C, SPI, URAT (aka Serial) and CANBUS (in particular UAVCAN)

3.2. FRAME

The frame type depends on the application, and weight requirement of the drone. Recommended frame for the said application are Hexacopter and octocopter. Due to high stability and weight lift capacity.

Recommended:

S550 Hexacopter frame

Tarot X8 OctoCopter frame.

Drone type and weight lift capacity:

Drone frame type	Weight lift capacity (hypothetical approximation)
Quad-copter	0.3-2 Kg
Hexacopter	Up to 20 kg
Octocopter	Up to 220 kg
Fixed-wing aircraft	5 kg (efficient than multirotor and can fly at higher altitude)

Note: The weight capacity of the drone depends on the design of the drone (MOTOR). Design may vary depending on payload, altitude or efficiency requirement.

3.3. MOTOR

Most drones use DC brushless motors. There are two types of motors, i.e. Clock wise (CW) and counter clockwise (CCW) the motors have a KV rating (RPM/V) and weight lift capacity For Rs2205 motor have a thrust of 1024 gm per motor (1.23 kg) so for quad copter the thrust is 1024X4 =4096 gm (4.096 kg) for stable flight the drone should have at least 2:1 lift to weight ratio.

3.4.ELECTRONIC SPEED CONTROLLER (ESC)

It controls speed of the motor as per directed by the flight controller or operator. Check the motor specification before purchasing ESC(s).

3.5.TELEMETRY KIT

It provides measurements and data such as altitude, speed, direction, position, battery, range, or signal strength between RC and drone remotely to your phone or laptop. It gives drone more autonomy and allows you to preset your flight plan.

3.6.TRANSMITTER AND RECEIVER

There are many RF transmitters available in the marker of different specifications and prices. With 2.4 GHz most widely used, preferably 8- 10 channel transmitter and receiver. 2.4 GHz will give you theoretical range of 1 km. but with some technique you can boost it up to 32 Km according to some sources.

Recommendation: FLYSKY- FSi6s 2.4 GHz Radio Controller.

3.7.BATTERY

The drones use Lithium Polymer batteries which have high density power storage capacity compared to normal batteries. Lasts longer and are rechargeable.

3.8.FREQUENCY RANGEAND FLIGHT TIME

Frequency range: The range of the transmitter determines the range of the drone. Radio transmitter have a range of on average couple of Km ranging from couple of meters to couple of kilometers, highest recorded to be hundreds of kilometers plus.

Flight Time: Depends on the range of variables like weight, power consumption and battery capacity.

3.9. SERVO MOTOR

There are two types of servo motor, 180 degree and 360degree servo; we use this at the output terminal to trigger the release of chemical, primarily through release mechanism (Eject able flare) or triggering circuit.

Note: When designing a drone examine the parameters for project requirement such as weight lift requirement (refer to weight chart), frame, altitude requirement, battery capacity, Motor, Electronic motor speed controller (ESC), frequency range, flight time, and most importantly the flight controller. For demonstration purpose we are using a quad copter but for intended purpose hexacopter or octocopter is recommended as it provides more stability in cross winds and higher weight lift capacity.

4. METHODS OF CLOUD SEEDING

- **Static cloud seeding.**
- **Dynamic cloud seeding.**
- **Hygroscopic cloud seeding.**

Static Method: This method involves spreading a chemical like silver iodide into clouds. The silver iodide provides a crystal around which moisture can condense. The moisture is already present in the clouds, but silver iodide essentially makes rain clouds more effective at dispensing their water. The window of opportunity for cloud seeding appears to be limited to the static mode of cloud seeding has been shown to cause the expected alterations in cloud microstructure including increased concentrations of ice crystals, reductions of super cooled liquid water content, and more rapid production of precipitation elements in both cumuli3 and orographic clouds; (1)

Clouds those are relatively cold-based and continental; (2) Clouds having top temperatures in the range —10 °C to —25 °C; 3) A timescale limited by the availability of significant super cooled water before depletion by entrainment and natural precipitation processes.

Dynamic Cloud Seeding: Dynamic cloud seeding aims to boost vertical air currents, which encourages more water to pass through the clouds, translating into more rain. Up to 100 times more ice crystals are used in dynamic cloud seeding than in the static method. The process is considered more complex than static cloud seeding because it depends on a sequence of events working properly. Dr. William R. Cotton, a professor of atmospheric science at Colorado State University, and other researchers break down dynamic cloud seeding into 11 separate stages. An unexpected outcome in one stage could ruin the entire process, making the technique less dependable than static cloud seeding.

Hygroscopic Cloud Seeding: The term —hygroscopic seeding has been associated with warm cloud seeding. The objective is to enhance rainfall by promoting the coalescence process using hygroscopic salt nuclei generated by pyrotechnic flare or a fine spray of highly concentrated salt solution. In addition, Cooper et al.4 illustrated that hygroscopic seeding might have a beneficial effect on precipitation development through either of two distinct mechanisms: (i) Introduction of embryos on which raindrops form. (ii) Broadening of the initial droplet size distribution resulting in acceleration of all stages of the coalescence process. In 1990, G. Mather reported a case of inadvertent seeding of clouds by hygroscopic particles emitted from Kraft Mill in South Africa that resulted in enhanced coalescence and rainfall. This observation led to further hygroscopic cloud seeding experiments in South Africa, 4, 9, Thailand18, Mexico1 and India with highly encouraging results. Additional experiments have been conducted more recently in Texas using powdered salt having particle diameters of 2 to 5 microns.

6. CONCLUSION

We have learned how the technology of cloud seeding works. The various methods used and under what circumstances a certain method is preferred. Understood the microphysics of clouds and the atmospheric conditions in which precipitation occurs. Learned about the components and how to build and execute the process in a cost-effective manner, and Furthermore, how it will tackle water scarcity of an area, the benefits of cloud seeding and how it could improve the economy, the weather, and the how it could improve water supply.

References/Articles:

1.”www.robu.in” (Drones/Components)

2. “https://en.m.wikipedia.org/wiki/Cloud_seeding”

3. “http://iceflares.com” (cloud seeding chemicals Ref: Fig 1.2, Fig 1.3)

4.”https://youtu.be/FhlMFzumsVg” (Drone Hardware)

5.” https://youtu.be/lcU0HQje1PY“(Programming APM 2.8)

6. “https://en.m.wikipedia.org/wiki/Vincent_Schaefer” (Inventor of cloud seeding)

BIOGRAPHIES

Prof. Asha Sanap dept of Electronics and telecommunication Engineering.

Prof. Neha Dutte, dept of Electronics and Telecommunication Engineering.

Master. Rohan J. Vijapure pursuing Diploma in electronics and telecommunication engineering in MIT Polytechnic, Pune. presently studying third year of diploma.

Master. Viraj V. Memane, pursuing Diploma in electronics and telecommunication engineering from MIT Polytechnic, Pune.

Master. Shivam S. Chavan, pursuing Diploma in electronics and telecommunication from MIT Polytechnic, Pune.

Master. Soham S. Maranholkar. pursuing Diploma in electronics and telecommunication engineering from MIT Polytechnic, Pune.