Project Report on

Implementation Of Swarm Drones Using Near Field Radio Frequency for Fire Fighting

Submitted in partial fulfilment for the award of the degree
Of

BACHELOR OF ENGINEERING
in
ELECTRONICS & TELECOMMUNICATION ENGINEERING

By

Arvita Khinvesra
Divesh Gadhvi
Honey Pardiwala

Under the Guidance of

Mr. Nikhil Tiwari

Associate Professor

Department of Electronics & Telecommunications

Choice Based Credit Grading System with Holistic Student Development (CBCGS-H 2019)

Zagdu Singh Charitable Trust's (Regd.)
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1st cycle of NAAC Accreditation : • "A" Grade for 5 years (w.e.f. 30-10-2017)

CERTIFICATE

This is to certify that Arvita Khinvesra, Divesh Gadhvi and Honey Pardiwala are bonafide students of Thakur College of Engineering and Technology, Mumbai. They have successfully carried out the project titled "**Implementation Of Swarm Drones Using Near Field Radio Frequency for Fire Fighting**" in partial fulfilment of the requirement of B. E. Degree in Electronics and Telecommunication Engineering of Mumbai University during the academic year 2018-2019. The work has not been presented elsewhere for the award of any other degree or diploma prior to this.

(Signature) **Mr. Nikhil Tiwari** **(Internal Guide)**	**(Signature)** **Name:** **(Internal Examiner)**	**(Signature)** **Name:** **(External Examiner)**

(Signature) **Mr. Manoj Chavan/** **Mr Shailendra Shastri** **Project Co-ordinator**	**(Signature)** **Dr. Vinitkumar Dongre** **HOD-EXTC**

Thakur College of Engineering & Technology
Kandivali (East), Mumbai - 400101

Date: 22/04/2020

Place: Mumbai

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In the end, we would also like to thank our parents, who have provided us with all possible resources to gain the best possible knowledge.

Arvita Khinvesra (EXTC A 05)

Divesh Gadhvi (EXTC A 22)

Honey Pardiwala (EXTC A 63)

ABSTRACT

Since the dawn of time, mankind has used fire to improve and enrich our lives. However, fire is a two sided blade. Each year cities experience fire in buildings, forests, industries etc damaging property and risking life. Extinguishing this fire is also a risk to human life.

If drones can perform such task there is no need for human's to risk their lives. Drones are unmanned aerial vehicles that have a widespread use in today's world. Despite the multiple advantages, one of the gruesome tasks is maneuvering multiple drones with separate control units as it becomes tedious and expensive and it requires a specialist. We could overcome this drawback by using a single control unit to maneuver multiple drones. This can be done using Swarming. UAVs can handle dangerous and risky tasks as well as their fast and efficient performance allows them to be used in fire related problems such as entering and exploring disastrous zones. An Auto Fire Off (AFO) ball is attached to each drone, which will be dropped at the location of the fire by each drone exactly at the same time as the master drone. This will avoid human casualties.

This project reduces labor as well as risk to human life thus bringing a change to society. We were inspired by the ease with which multiple drones can be controlled using a simple unit and how a simple AFO ball can be used to extinguish large fires, thus saving many human lives.

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CHAPTER 1
OVERVIEW

1.1 Background

With the world becoming a smaller place to live in with each passing day, interdependence is increasing and this has given a whole new importance to the field of research. Also, the threat to human life has also increased by the functions involving research and security, so there is a need to replace humans by machines. Our Project aims at simulating a prototype of an unmanned aerial vehicle that Primarily consists of a Master drone and a Slave drone that uses the "Swarming Technology" that has the potential to distribute tasks and coordinate the operation of many drones with little to no operator intervention. Through its added features our project aims at creating a model that will be an important aid in various applications, Disaster Management being the Prime target of our project so that we are able to reduce human casualties.

Rationale for taking up the proposed project and its interdisciplinary relevance: According to the Real Time Forest Alert System of the Forest Survey of India (FSI), the number of forest fires shot up to 14,107 from 4,225 between November 2018 and February 2019 . The existing human involved fire fighting system has following major drawbacks:
(1) firefighters safety cannot be guaranteed .
(2)Requires additional effort to detect fire and actuate the location.
(3)Accessibility to hazardous industrial area and forests is quite limited.
The project attempts to provide an upper hand to the existing fire fighting systems by overcoming the above mentioned disadvantages and reducing Human Intervention.

1.2 Literature Survey:

General India Drone Laws:
Drone use is allowed in India, however there are many drone laws that require to be followed once flying within the country. Operators should make sure that they follow the subsequent drone laws once flying a drone that weighs over 250 grams in India,

- Do not fly your drone over densely inhabited areas or massive crowds
- Respect others privacy once flying your drone
- Do not fly your drone among 5km of airports or in areas wherever craft are operative
- You should fly throughout daylight and solely fly in atmospheric condition conditions
- Do not fly your drone in sensitive areas together with government or military facilities. Use of drones or camera drones in these areas are prohibited
- You should be a minimum of eighteen years recent and have completed a coaching course
- All drones should be equipped with a vehicle plate distinctive the operator, and the way to contact them
- You should solely fly your drone among visual line of sight
- You cannot fly quite one UAV at a time
- Do not fly your drone among 50km of a border
- Do not fly your drone quite five hundred meters into the ocean, from the outline
- Do not fly among 5km of Vijay Chowk in metropolis

SR. NO	PAPER TITLE	YEAR OF PUBLICATION	AUTHORS	DESCRIPTION
[1]	Swarm Intelligence and its Applications	IEEE 2011	Caichang Ding, Lu Lu, Yuanchao Liu, and Wenxiu Peng School of Computer Science, Yangtze University, Jingzhou, Hubei Province, China	Swarm Intelligence is a computational and behavioral metaphor for solving distributed problems inspired from biological examples provided by social insects such as ants, termites, bees, and wasps and by swarm, herd, flock, and shoal phenomena in vertebrates such as fish shoals and bird flocks.
[2]	A Review and Future Directions of UAV Swarm Communication Architectures	IEEE 2018	Mitch Campion, Prakash Ranganathan, and Saleh Faruque Department of Electrical Engineering University of North Dakota Grand Forks, ND 58203	The utility of unmanned aerial vehicles (UAVs) has significantly disrupted aviation-related industries. As technology and policy continue to develop, this disruption is likely to continue and become even larger in magnitude. This paper surveys literature regarding UAV swarm and proposes a swarm architecture that will allow for higher levels of swarm autonomy and reliability
[3]	Design and implementation of an unmanned aerial vehicle for autonomous firefighting missions	12th IEEE International Conference on Control & Automation (ICCA) Kathmandu, Nepal, June 1-3, 2016	Hailong Qin1, Jin Q. Cui1, Jiaxin Li2, Yingcai Bi2, Menglu Lan2 ,Mo Shan1, Wenqi Liu 1, Kangli Wang2, F. Lin1, Y. F. Zhang3, and Ben M. Chen2	This paper presents a design and implementation of an unmanned aerial vehicle (UAV) for outdoor firefighting application. The proposed UAV firefighting system consists of a self-designed quadcopter as platform, a transmission system to collect and release water, a real time kinematic (RTK) based navigation system and

				mission control system to monitor and coordinate the UAV.
[4]	The use of unmanned Aerial Vehicles for Disaster Management	2015	Ged F. Griffin University of Melbourne, Centre for Disaster Management and Public Safety	This paper discusses potential applications of unmanned aerial vehicles (UAVs) for disaster management. Based on the current state and diversity of research, there is considerable evidence to support the strategic investment in UAV technology to develop new and enhance existing operational capabilities.
[5]	Application of Swarm Intelligence in Disaster Management: A Review	IJFRCSCE | June 2018	Mohd. Daneel Khan Krantee Jamdaade	The efficient use of Swarm Intelligence in Disaster management is discussed in this paper. Many lives are lost in Disaster affected area, the rescue team cannot reach everyone to rescue them where Swarm Intelligence can be used. . SI can be used in searching and rescue operation in the disaster affected area, the swarm of Drones and bots deployed to locate the lives and give their exact location so that they can be rescued.

Table 1: Literature Survey

1.3 Scope:

In fields that pose a danger to human existence, there is a growing need to replace humans with machines and with the power of drones to make autonomous decisions, we are inching ever closer to seeing that potential unleashed.

Scientists estimate that wildfires have released about 8 billion tons of CO2 annually over the past 20 years. With the massive problems of climate change in today's world, new methods and technologies are desperately needed to help keep disasters in check.

In addition to the risks to human life, the main issue with extinguishing wildfires is that vast quantities of water will be required and 21 cities in India could run out of groundwater by 2020 according to the report.

The scope of this project is rather broad, as it will provide a solution to the above-mentioned problems and can be altered by simply adding or reducing the number of slave drones to the assistance required during the disaster time.

CHAPTER 2
PROPOSED WORK

2.1 Problem Definition:

To implement an algorithm to control drones synchronously using a single control unit and to implement a fire fighting mechanism for wildfires.

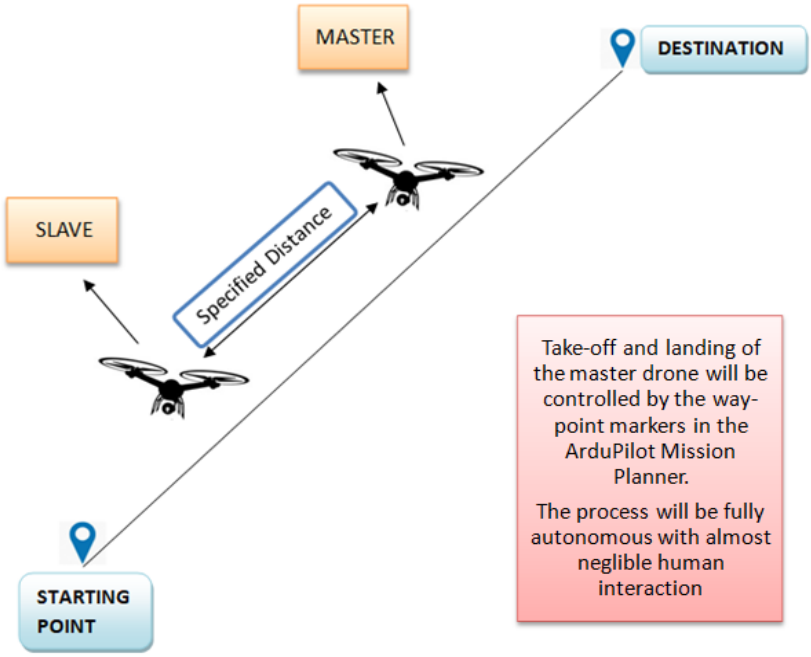

Figure 2.1: Working of Master And Slave.

Figure 2.2: Fire Extinguishing Mechanism.

2.2 As per guide's instruction:

- .We need to design a swarm of drones having one master drone and one slave drone in the prototype of our project.
- For that we have to calculate the rpm of the motors of the drone and choose the suitable design with respect to the payload of our drone.
- Then we need to check the composition of the AFO Ball and its physical dimensions to know whether it's weight can be held by the drone and if it is capable of extinguishing fires.
- Check the circumference covered by the AFO Ball to extinguish fire after it drops and blasts.
- Work on how the ball is to be held by the drone and it's dropping mechanism when it reaches the sight of fire.
- Installing ultrasound sensors and camera for obstacle detection so that the drone reaches the sight of fire properly.

2.3 Data Flow Diagram:

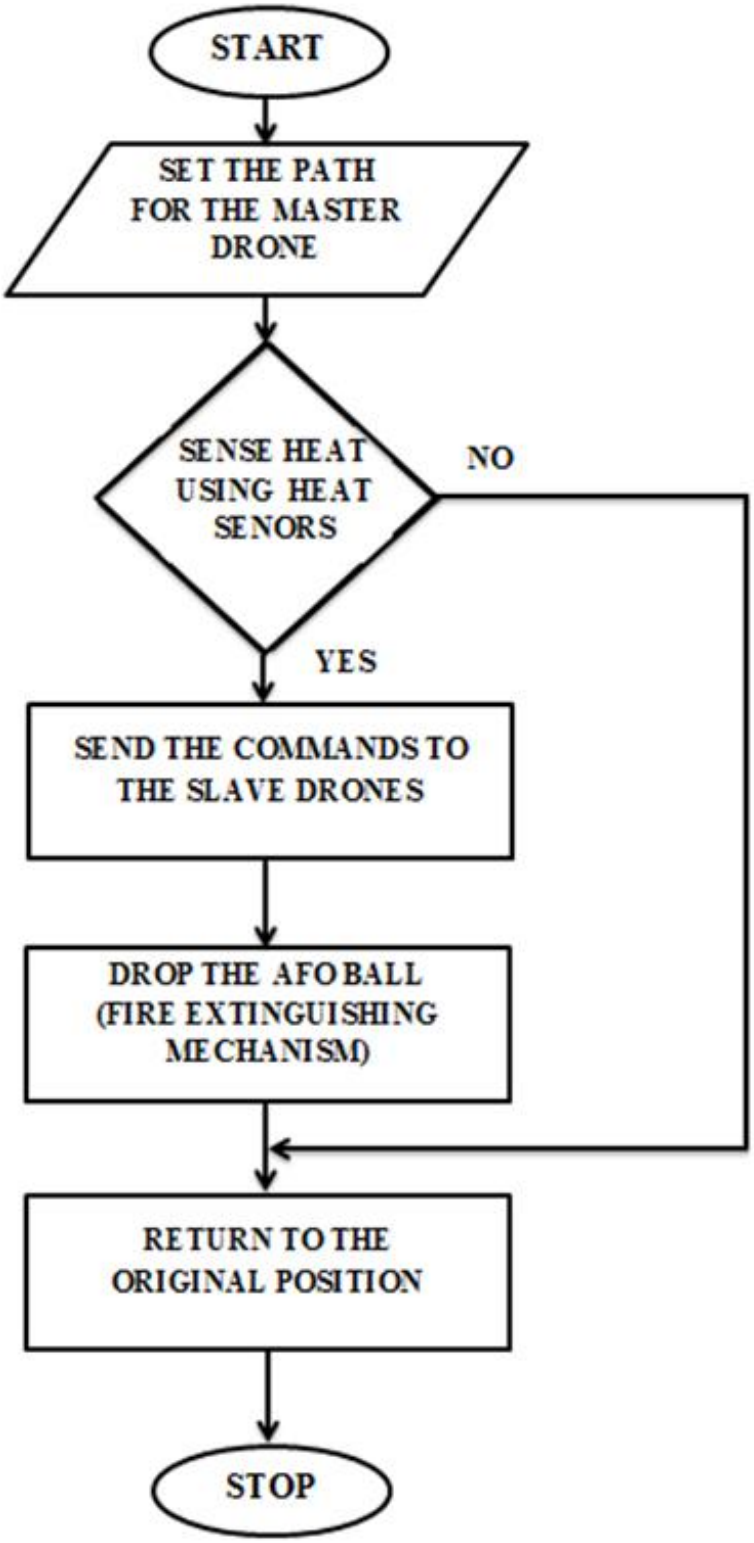

Figure 2.3 Concept Map for Drone.

CHAPTER 3
ANALYSIS & PLANNING

3.1 Feasibility Study:

3.1.1 Proposed Block diagram:

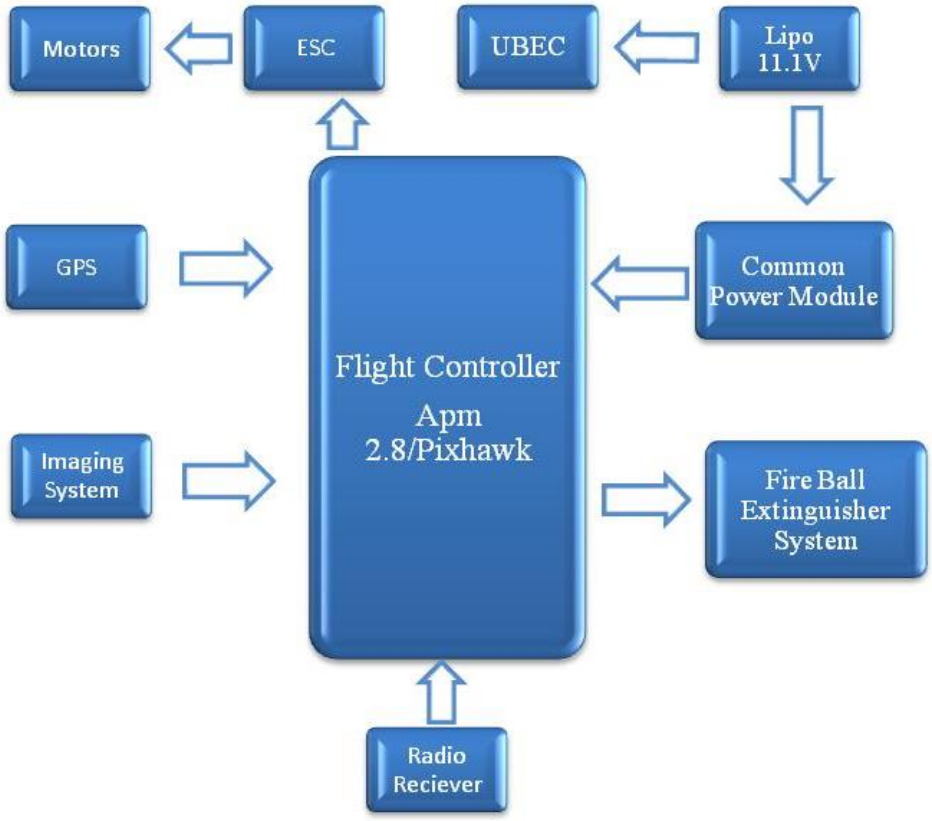

Figure 3.1: Block Diagram of A Drone with sensors and AFO Ball

3.1.2 Estimated Design Cost:

Product	Quantity	Price	Total
1000kv A2212 Brushless Motor with Simonk 30A ESC For RC Airplane / Quadcopter / Multirotor	12	₹779	₹9,349
iMax B3 Lipo balance Charger for 2-3 cell Lipo Battery	2	₹349	₹699
ZOP Power LiPo Battery 11.1V 2200MAH 3S 25C	2	₹1500	₹3000
3D printed Shockr Anti-vibration Set for APM Pixhawk	2	₹299	₹599
Landing Gear Skid for Frame	2	₹199	₹399
TOWER PRO 9G MICRO SERVO MOTOR	2	₹119	₹239
1045 Propeller 10in 10x4.5 For Drone	6	₹99	₹599
Battery Voltage Tester Monitor and Buzzer Alarm	2	₹169	₹339
FlySky FS-i6 2.4G 6CH AFHDS RC Transmitter With FS-iA6 Receiver	2	₹4,719	₹9,439
Carbon-Fiber Hexacopter frame Kit	2	₹1,799	₹3,598
GPS Folding Antenna Metal Holder	2	₹299	₹599
GPS Module Ublox NEO-7M With Electronic Compass for Apm/Pixhawk	2	₹1,888	₹3,779
APM2.8 Flight Control Board for RC Multi Rotor Drone	2	₹2,999	₹5,999
APM Pixhawk Power Module with XT60	2	₹699	₹1,399
Telemetry	2	₹1,999	₹3,998
FPV Camera Gimbal	1	₹2,499	₹2,499
FPV SJCAM SJ6 Camera	1	₹3,000	₹3,000
Auto Fire Off (AFO) Fire Extinguisher Ball	2	₹960	₹1,920
Miscellaneous (Damage Cost)			₹3,000
TOTAL			₹51,920

Table 2: Design Cost

3.2 Project Planning:

3.2.1 Technical Approach of the Project:

- Initially, we will study how drones work, the concept of Swarming and how AFO balls are used.
- We will then acquire the desired components for building both the drones.
- We will start with the set up and calibration of the Master and the Slave drones and monitor it's flight.
- We will then set up communication between the Master and the Slave Drone.
- We will attach a dropping mechanism for the AFO ball on both the drones.
- We will then test the working of the project.

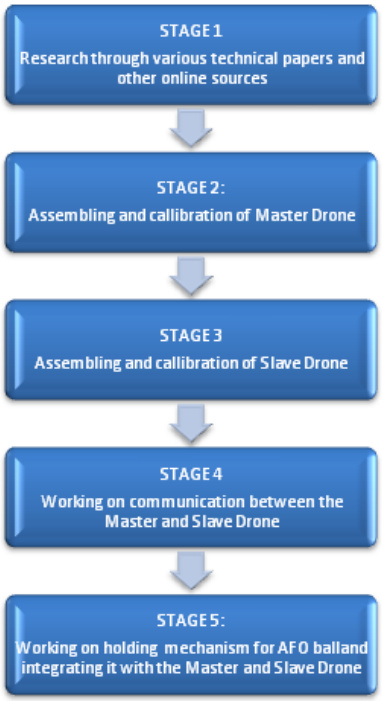

Figure 3.2: Methodology of the Project.

3.2.2 Objectives:

The main objective of our project is to reduce the complexity and cost of drones by using Swarming. We plan to use it in Disaster Management, mainly fire fighting which will help us reduce the risk to human lives and increase the efficiency of extinguishing forest fires thus impacting society in a large way.

3.3 Scheduling (Timeline chart):

TASK	Jul -19	Aug -19	Sep-19	Oct-19	Nov -19	Dec-19	Jan -20	Feb -20	Mar -20	Apr -20
Selection of Group and finalization of Domain.										
Selection of topics based on the Domain.										
Research on the selected topics along with cost approximation.										
Literature survey										
Presentation on the selected topics and finalization of topic.										
Study of quadcopter & research on extension on quadcopter that can be done.										
Implementation and Building of the hexacopter										
Preparation of Bluebook										
Motors and ESC's calibration										
Studying about AFO Ball and Implementation of dropping mechanism										
First flight test										
Flight time and payload test										
Black Book preparation & submission										

Table 3: Scheduling Chart

CHAPTER 4
DESIGN

4.1 Basic Block Diagram:

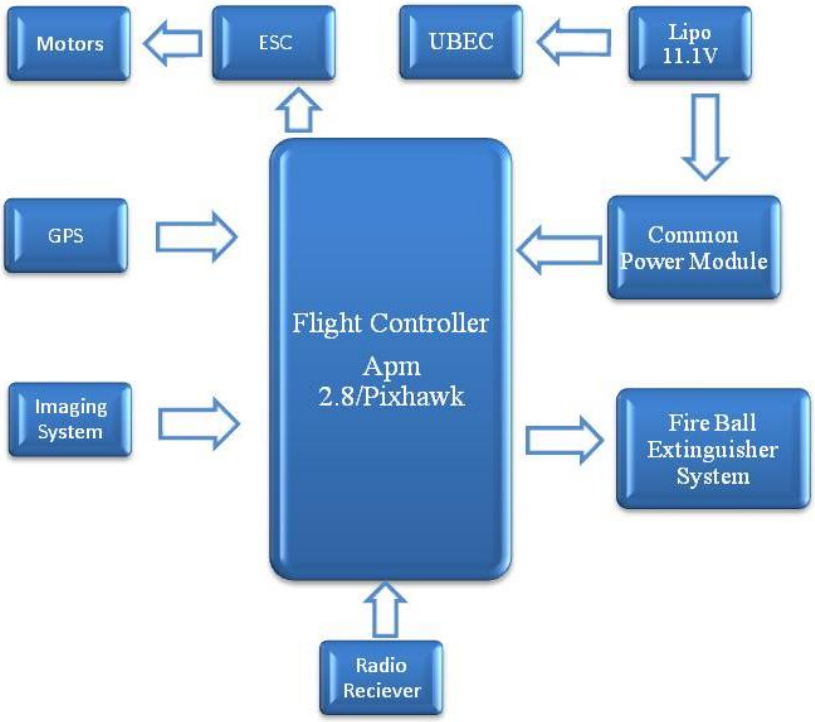

Fig 4.1: Basic Block Diagram of a Drone

- Swarming is a process in which honey bees move while following the queen bee. The same formation can be implemented using drones. An AFO ball is attached to all the drones in order to extinguish fire and help in disaster management.
- The method of controlling multiple drones with a single unit depends low key on a single factor i.e. the distance maintenance. Each UAV contains a modifiable parameters which determines the distance that the copters should maintain.
- Multiple options were explored for the distance between two UAVs. RSSI was the first option that was considered but it turned out to be noisy. Computer vision techniques can also be utilized in which each copter surveys the surrounding area with the help of a camera. However, this method becomes complex as well as pricey because the camera needed should capture in all directions.
- The technique which was of our convenience used GPS coordinates. Here each copter was made aware of the GPS coordinates of the surrounding copters. This has its own flaws, one being that GPS is not always reliable technology and before flight it's important to verify the distance between the copters. As long as the verifications are done the method provided turns out to be quite efficient.
- The two important aspects of the project are:

  A. Copter Communication

  B. Fire Fighting Mechanism

4.1.1 Designing of Drone

3 cell Lipo battery of 2200mah, with a capacity of 11.1 Volts provides the power to the drone. The carbon fibre frame with 550 dimension and an aerodynamic design supports the drone. The 1000 kv motors with an rpm of 1000 provides enough thrust to the drone to be stable at a position above the ground. The propellers of carbon fibre material each of which are 10 inches long manage to hold up the weight of the hexa-copter along with some extra load attached. The landing gear with four limbs provides safety to the drone while landing even on a rough surface.

Fig 4.1.1:Mechanical Design of Hexa-copter

4.1.2 Copter Communication:

- The copters were communicating with each other via wireless transceivers of 2.4 GHz. One transceiver was added to each copter along with an Arduino, with the Arduino acting as the bridge of communication between the APM autopilot and the transceiver.
- The APM sends data via UART to an Arduino, at 4 Hz. The Arduino takes the information it receives, and sends it via the 2.4 GHz transceiver to the other copter. On the other hand, once that information is obtained by the other copter's Arduino, the Arduino must store the data and wait until it’s APM is ready to read it.

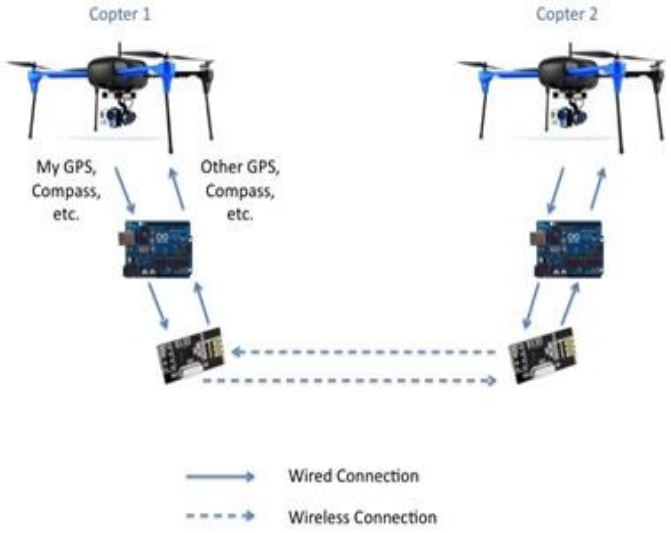

Fig 4.1.2: Communication between two copters

4.1.3 Fire Fighting Mechanism:

- The path for the master drone is set. The master drone communicates with the slave drones. The slave drones then follow the master maintaining a specified distance.
- The heat sensor on the master drone senses the fire and sends the command to all the slave drones. Upon getting the command, all the drones drop the Auto Fire Off ball.
- The outer covering of the AFO ball in presence of fire, melts and releases Mono Ammonium Phosphate to extinguish the fire.

4.1.4 AFO Ball Dropping Mechanism:

We use the arduino UNO and connect it to the temperature sensor. The three pins of the LM35 temperature sensor are connected to the input pin A0,+5V and GND respectively. The temperature sensor senses the temperature outside and updates it on the serial monitor. The Servo motor is connected to the pulse width modulation PIN 6. The servo motor is connected with the claw structure which holds the AFO ball.

Diode 1N4007 is connected in parallel to the motor such that moving current doesn't cause damage to the arduino kit when in the opposite direction.

NPN transistor BC547 is connected along with a 1k resistor to the PWM PIN 6 of the arduino UNO.

External 9 or 12 V battery source is connected to the motor and grounded with the emitter of the transistor.

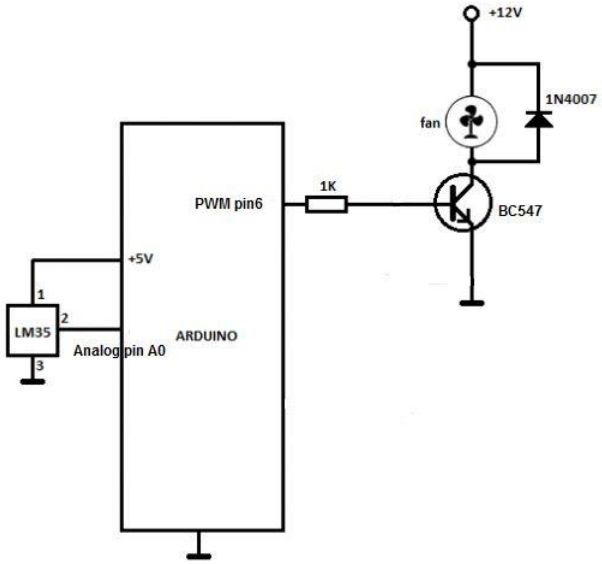

Fig 4.1.3: Connection Diagram to integrate heat sensor and servo motor on Arduino

Code for integrating temperature sensor and servo motor:

```
float temp;
int tempPin = A0; //arduino pin used for temperature sensor
int tempMin = 90; // the temperature to start the buzzer
int motor = 6; // the pin where motor is connected
int motorSpeed = 0;
void setup() {
pinMode(motor, OUTPUT);
pinMode(tempPin, INPUT);
Serial.begin(9600);
}
void loop() {
temp = analogRead(tempPin);
temp = (temp *5.0*100.0)/1024.0; //calculate the temperature in Celsius
Serial.println(temp);
delay(1000); // delay in between reads for stability
if(temp < tempMin) { // if temp is lower than minimum temp
motorSpeed = 0; // motor is not spinning
digitalWrite(motor, LOW);
}
if(temp >= tempMin) //if temperature is higher than the minimum range
{
motorSpeed = map(temp, tempMin, 100); // the actual speed of motor
analogWrite(motor, motorSpeed); // spin the motor at the motorSpeed
speed
}
}
```

CHAPTER 5
RESULTS

5.1 Results:

The master drone on consuming 80% of the battery, can achieve a flight time of about 15-20 minutes. These observations were made in ideal conditions, and the drone was kept at a stable altitude for all the flight tests. The battery capacity is 2200 mah. A payload of 1.5kg can be lifted by the drone, but at the cost of the flight time.

Currently we have completed the assembly of the master drone in which we have connected all the 6 motors to the model. Motor 1, 3 and 5 will rotate in clockwise direction and motor 2, 4 and 6 will rotate in anti-clockwise direction.

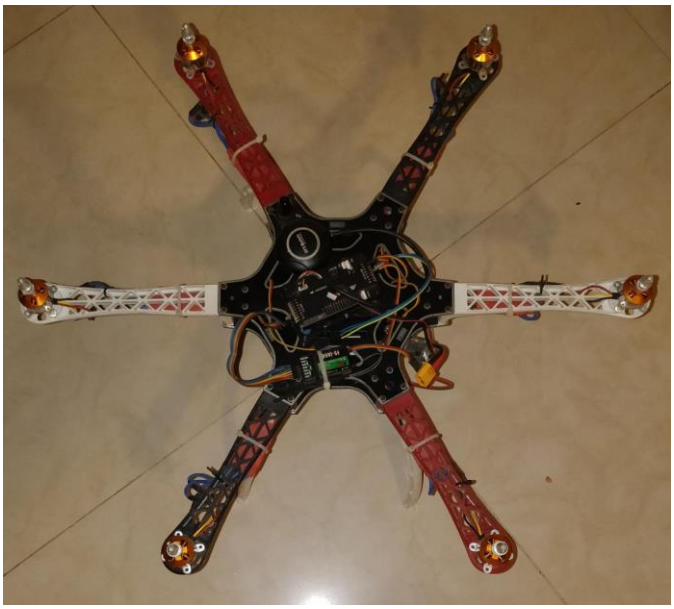

Fig 5.1: Completed Master drone

5.2 Expected Outcomes:

- Two drones, one master and slave are used. The path is only fed to the master drone. The slave replicates the movement of the master drone blindly. The position of the slave will be maintained with respect to the master at a specified distance.
- On sensing fire from the heat sensor, the master and the slave will drop the AFO ball at the same time. When the AFO ball comes in contact with the fire, its outer plastic covering will melt thus releasing the chemical substance inside it and extinguishing the fire.

CHAPTER 6
CONCLUSION

In this semester's project work:

1. We have worked on the calibration of the motors and ESC of the master drone.
2. We have understood the holding and dropping mechanism of the Auto Fire Off (AFO) ball.
3. We did the flight test of the master drone.
4. We worked on the time of flight and payload test, i.e how much weight can be carried by the drone.
5. We worked on integrating the GPS module with the drone.

The current state and scope of research offers substantial evidence supporting strategic investment in UAV technology to develop new and improve existing disaster management operational capabilities. The swarm of drones can also help save lives from disaster-affected areas by finding them and providing information to the rescue team by providing pathway and area information. According to the work proposed by previous research papers, the fire extinguishing mechanism used was water pumps. Major drawback of this mechanism was the wastage of resources and high power consumption. As an alternative here we use AFO ball as a fire extinguishing mechanism as it is more efficient than the other mechanisms mentioned in other research papers. Using a dropping mechanism, the Auto Fire Off Ball will be dropped into the fire from all the drones in order to extinguish the fire. The agent used inside the ball is an active material of 94 percent MAP (mono ammonium phosphate)-dry chemical powder, one of the highest percentages of MAP found in dry chemical powder. It is healthy and environmentally friendly for humans, plants and animals.

CHAPTER 7
DATASHEETS

7.1 Datasheet for APM 2.8:

The APM 2.8 Multicopter Flight Controller is a complete open source autopilot system. It allows the user to turn any fixed, rotary wing or multirotor vehicle (even cars and boats) into a fully autonomous vehicle; capable of performing programmed GPS missions with waypoints. APM 2.8 Multicopter Flight Controller has a Built-in Compass for FPV RC Drone Aircraft. This makes the APM 2.8 ideal for use with multi-copters and rovers where the compass should be placed as far from power and motor sources as possible to avoid magnetic interference. On fixed wing aircraft it's often easier to mount APM far enough away from the motors and ESCs to avoid magnetic interference so that the GPS/Compass unit can be mounted further from noise sources than APM itself.

Features:

- Straight Needle
- Arduino Compatible.
- Onboard 4 MegaByte Dataflash chip for automatic data logging.
- Optional off-board GPS, a uBlox LEA-6H module with Compass.
- One of the first open source autopilot systems to use Invensense's 6 DoF Accelerometer/Gyro MPU-6000.

Fig 7.1: APM 2.8 Multicopter Flight Controller

Specifications:

- Model: APM 2.8
- Power supply: LP2985-3.3.
- Port: MUX (UART0, UART2, mnI2, and OSD are optional, OSD is the defaulted output).
- Input Voltage (V): 12-16 VDC
- Sensors: Axis Gyrometer, Accelerometer, High-performance Barometer
- Processor: ATMEGA2560 and ATMEGA32U-2
- No Micro-SD Card Slot
- Dimensions (mm) LxWxH: 85 x 45 x 15
- Weight: 82gm

7.2 Datasheet for GPS Module Ublox NEO-7M:

Ublox Neo 7M GPS module that includes an HMC5883L digital compass. The Ublox NEO 7 series is a high sensitivity, low power GPS module that has 56 channels and outputs precise position updates at 10Hz. This GPS module also comes with a molded plastic case which keeps the module protected against the elements making it ideal for use on your aircraft or quadcopter.

This Ublox Neo 7M GPS module uses an active circuitry ceramic patch antenna to provide excellent GPS signal which outperforms the older Ublox Neo 6 series modules. This Ublox Neo 7 module also includes a rechargeable backup battery to allow for HOT starts and also includes an I²C EEPROM to store the configuration settings. Out of the box this GPS module is configured to run at 38400 Baud and is configured to run with APM/Pixhawk systems. This GPS module includes two cables, a 6pin connector for the GPS module and a 4 pin connector for the i2c compass.

Features:

1. Locate performance
2. These are Pre-configured, Flashed with the correct settings, and tested.
3. Super Bright LED
4. Backplane with Standard Mk style mounting holes 45mm X 45mm
5. 38400 bps (Default) Changed to 115200bps!
6. Output GGA, GSA and RMC frames
7. 1Hz (Default) Changed to 5Hz!
8. Permanent Configuration Retention
9. Compass on board
10. 6 pin connector for EZ connect to MEGA BLACK
11. 4 pin connector for only GPS use
12. 4 pin connector for compass only use
13. Can use both 4 pin at once.

Fig 7.2.1: GPS Module Ublox NEO-7M

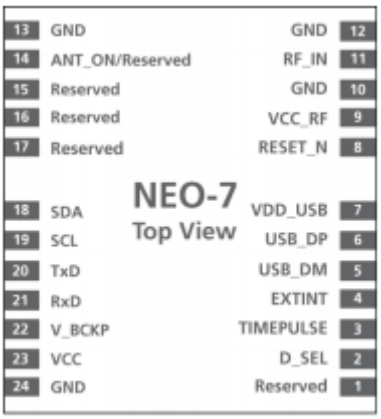

Fig 7.2.2: Pin Diagram For GPS Module

No	Module	Name	I/O	Description
1	All	Reserved	I	Reserved
2	All	D_SEL	I	Interface select
3	All	TIMEPULSE	O	Time pulse (1PPS)
4	All	EXTINT	I	External Interrupt Pin
5	All	USB_DM	I/O	USB Data
6	All	USB_DP	I/O	USB Data
7	All	VDD_USB	I	USB Supply
8	All	RESET_N	I	RESET_N
9	All	VCC_RF	O	Output Voltage RF section
10	All	GND	I	Ground
11	All	RF_IN	I	GNSS signal input
12	All	GND	I	Ground
13	All	GND	I	Ground
14	NEO-7N	ANT_ON	O	Antenna control
	NEO-7M	Reserved	-	Reserved
15	All	Reserved	-	Reserved
16	All	Reserved	-	Reserved
17	All	Reserved	-	Reserved
18	All	SDA SPI CS_N	I/O	DDC Data if D_SEL =1 (or open) SPI Chip Select if D_SEL = 0
19	All	SCL SPI CLK	I/O	DDC Clock if D_SEL =1(or open) SPI Clock if D_SEL = 0
20	All	TxD SPI MISO	O	Serial Port if D_SEL =1(or open) SPI MISO if D_SEL = 0
21	All	RxD SPI MOSI	I	Serial Port if D_SEL =1(or open) SPI MOSI if D_SEL = 0
22	All	V_BCKP	I	Backup voltage supply
23	All	VCC	I	Supply voltage
24	All	GND	I	Ground

Table 4: Pin Assignment for GPS Module

7.3 Datasheet for Telemetry:

This wireless data transmission is designed according to the design of new 3DR data transmission. The wiring is complete, and the independent housing is added. It is safer and more beautiful. The data transmission is more stable. It does not distinguish between the ground end and the air end. The two pieces are exactly the same, all with USB, and 6pin serial port dual TTL design, don't need to use any tools, users can upgrade firmware by themselves.

Description:

- Item Name: 3DR Radio Telemetry Module
- Support to MWC/APM/Pixhawk flight control
- Weight: 50g
- Optional Version: 433 Mhz

Features:

- Small size and lightweight
- CP2102 high quality USB to TTL chips
- 433 MHZ
- Support MWC/APM/PX4/Pixhawk other open source flight control
- Receiver sensitivity of 118 dBm
- MAVLink Framework Agreement
- Open Source Firmware* Frequency hopping spread spectrum(FHSS)
- 2-way full duplex communication adaptive TDM
- Up to 25% can be corrected bit errors
- Based Si1000 and Si4432 wireless microcontroller modules.

Fig 7.3: 3DR Radio Telemetry Module

7.4 Datasheet for Auto Fire Off (AFO) Ball:

Fire Extinguishing Ball is a ball shaped fire extinguisher. It comes with a wall mounting bracket, and can even be operated manually.

Its main features are:

- EASY TO USE:- One of the great benefits of fire extinguishing ball is the fact that it can self activate in the presence of fire, when no one is present. If positioned in the appropriate high risk area where most fires are likely to start, it will self activate within 3 to 5 seconds upon reaching the appropriate temperature and extinguish the fire.
- NO NEED FOR SPECIAL MAINTENANCE:- For a period of 5 years without maintenance required, always on guard with its unique capability to emit loud noise of 101 decibel as a fire alarm upon activation.
- SAFE AND EFFECTIVE:- There is no need to be close to the scene of fire thus preventing injuries and casualties. The chemicals present in the ball are not harmful to the environment as well at the human body.

Fig 7.4: Auto Fire Off Ball

Specifications:

- Self Activating: Simply throw or roll into a fire and it will self-activate within 3 – 5 seconds
- Coverage: It covers 360-degree angle, area of about 70 to 80 sq ft.
- Size and shape: spherical with a diameter of 14.5cm
- weight: 1.3KG
- Type of fire extinguisher: dry powder extinguisher which is a chemical called MONO Ammonium Phosphate
- Trigger conditions: contact the flame for 3 to 5 seconds to automatically extinguish the fire Validity: 5 years Automatic reaction time: 3-5 seconds
- Ease of use: Minimal training costs, no pins, and no moving or mechanical parts.
- Have sound level impulsive noise 101dB*-140dB* as a warning for fire and Fire Extinguishing Ball working.
- Fire Ball Set: Each fireball comes with a vibrant red and white vinyl adhesive sign that is sure to catch the attention - in case of an Emergency in your area
- Environment Friendly: Non-toxic, safe around people and pets, no inspection and maintenance requirement for life.

CHAPTER 8
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