



SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

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(An Autonomous Institution)

Madagadipet, Puducherry - 605 107



Department of Science and Technology – Govt. of India
Department of Computer Science and Engineering
PROPOSAL SUBMISSION
TITLE: MULTIPURPOSE DRONE SURVEILLANCE AND DETECTION

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Objectives

A drone was first emerged popular in the year 2010. It had a camera to do surveillance and also for other purposes like video shooting and etc. But due to technological advancements the drone has become an essential instrument in every field and in various developments of works. Now in present days, the drone is used for different fields such as agriculture, surveillance, drone mapping, detection of crack in dams, prediction of unrecognized entry during night time, delivering of products from a store to the customer, and etc.

Every drone has its own purpose. Drones such as agricultural drone can be implemented only for agriculture, industrial drone can be implemented only for industrial use, and some other flaws are there in the usage of these drone.

The main objective of our project is to implement a drone which can work for both agriculture and as well as industrial use. The instruments required for different purposes can be designed in such a way that it can be altered by just flipping the required sensor or instrument payload into it. So now, the drone design may be a universal design for various purposes implemented using the technic which may be termed by us as 'flipping instrument system management or FISM'.

Introduction

AGRICULTURE:

Recent technological development has improved a more advance technologies in computers and in other fields with various applications. One of the most important things in this modern advancement in technologies is Drone. Day by day drones are being used in various projects and also for commercial uses. Agriculture is the main source of India in which attention has to be kept. Nowadays farmers are being given very less profit in one or other way during the harvesting and selling. To overcome those issues, implementation of drone in the field for the surveillance of growth process and harvesting period and average cost to be sold are given to the farmer in one go, thereby giving solution the farmers to lead a better life.

Objectives:

Drones are implemented in agriculture purpose for spraying of pesticides and fertilizers. Also, they are used for other purposes such as, detection of pest infected area, for irrigation management and etc. Our drone also does the same purpose and also some other features like detection of crop defects, prediction of percentage of profit or loss, growth of the plant and etc.



A drone spraying pesticide in agricultural field

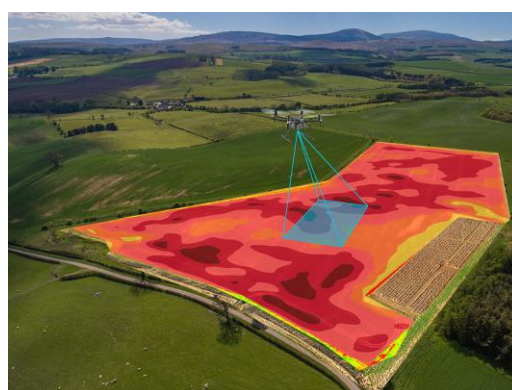
Using thermal imaging sensor/ camera, the disease affected area can be detected. The difference in coloring of the leaves or crop will change the wavelength of light reflecting from it producing variation in temperature is scanned by the thermal camera to sense the area of affection.

On the monthly basis, the images of the plants are taken and the growth level of the crop can be predicted. If the growth is not up to the mark, it means we have to search for the cause for it and by increasing amount of fertilizers or nutrients needed by the crop.

By using these images taken every month, the growth statistics can be defined and predicting the profit percentage of the crop/ acre or loss percentage.



Selection of area for thermal imaging



Thermal imaging of selected agricultural area

All this prediction is done using AI prediction technique by training the system with already taken images and implementation of it to produce us the output for our agricultural benefit.

Procedure:

The drone makes the surveillance of the broad acres of land in the particular region. For an example, let us consider an agricultural field of area 50 acres. These lands belong to various farmers producing different crops in their field.

What our drone does is, every week the drone goes on a surveillance of those 50 acres of land. The job of the drone is to find out the area of nutrient deficiencies, weed prediction, pest prediction, water management and etc.

The details of plant growth process and other details such as nutrient deficiency, pest prediction and etc. are saved into our database.

Now each and every farmers of the land covered are registered with our database and are given a login ID and password. By logging on to their respective log in ID, they can know all the details of their plants or crops and they can know when to harvest the crop, what are the areas of deficiencies, weeds and pests, whether the growth of plant is perfect for every month and other such details which are very useful for the farmers for the maintenance of plant growth.

In addition to it, the database can provide farmers the current price for the crop and they can select how much they want to sell it, according to those inputs, the system itself finds the correct party who is ready to buy the crop with that price and provides their details of contact directly to the farmers.

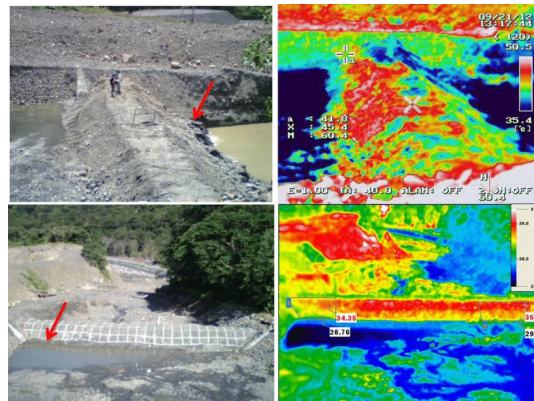
So here, the farmers only fix the rate for the selling of their crops or cereals, hence guiding them in a right path to earn more and lead a healthy and happy life.

But the main risk is, due to high voltage pass and high electromagnetic energy, the drone's Flight controller can get damaged or even get fried in worse conditions. To reduce the risk of these such things, the flight controller has to be insulated with ferro magnetic material to protect it.

During passing through the power line, in some places there are huge hike of interference of power line with the drone, to monitor that, spectrometer is used.

Dam leakage detection:

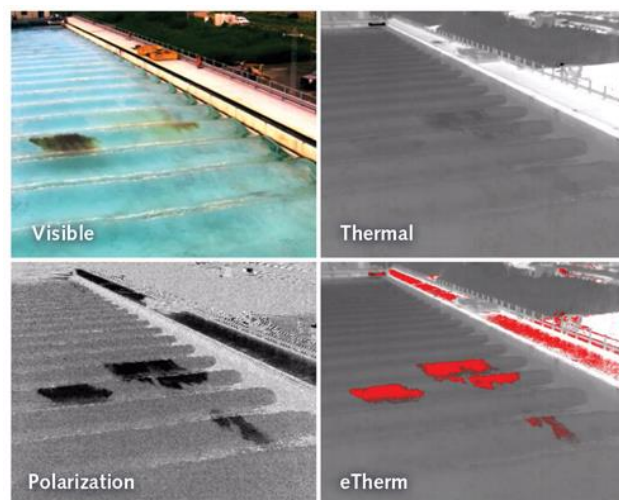
To prevent these difficulties, it is advised to maintain 100 feet gap between transmission line and drone.



Detection of water leakage in Earth dam

In this picture, the comparison of normal pic and thermal imaging can be seen. Using thermal imaging camera, the leakage in this earth dam can be easily identified. This is the way how a drone can be implemented for the identification of leakage of water in dam or crack in dam.

Oil spillage detection:



Comparison of how IR polarimeter can help us find the oil spillage area

In this above picture, we can clearly see the comparison of four different camera/sensor images. The use of IR polarimeter for oil spillage detection and other use can be implemented for more precise location of spillage or leakage area.

By using more precise and high-quality camera, defects of the industries such as crack detection in dams, over flow of gas or leakage prediction, and other purposes can be easily and precisely located using the live data transmission from the drone.

3D- Mapping:

Mapping of the particular area for industrial inspection and other such purposes can be implemented using drone for 3D imaging using the camera fitted into it. Mainly used for inspection of particular area for planning of structural dimensions and other uses.



DEFENSE:

The usage of drones in defense system of a country has increased. The unrecognized entry of terrorist during night time can be detected using thermal camera using the temperature of the human body which releases heat.

Not only detection of unrecognized entry but also defense equipment and first aid kit delivery during emergency conditions can be done.



1. USERS / USERS AGENCIES:

- a. Agriculturist
- b. Industrial workers

- c. Photography/ video shooting
- d. Defense agencies
- e. Private Organizations

2. ESTIMATED REQUIREMENT (NO. OF PIECE PER YEAR) OF THE PROPOSED DEVICE / SYSTEM:

Requirements Needed	No of Quantity
BLDC motor(with spare)	10
Electronic Speed Controller(with spare)	10
Propeller	20
Flight controller – DJI A3	1
Li-Po Battery	4
Transmitter and Receiver	1
Cameras and Gimbals	1
Frame	1
Telemetry	1
Range booster	1
GPS Module	1
Instrument Payload	4

3. ESTIMATED COST OF THE DEVICE /SYSTEM AFTER DEVELOPMENT:

Requirements Needed	No of Quantity
BLDC motor	70,000
Electronic Speed Controller	1,12,000
Propeller	20,000
Flight controller – DJI A3	40,000
Li-Po Battery	60,000
Transmitter and Receiver	95,000
Cameras and Gimbals	50,000
Frame	20,000
Telemetry	10,000
Range booster	30,000
GPS Module	20,000
LiDAR	30,000
Spectrometer	20,000
Sprayer	20,000
Thermal imaging camera	40,000
Tablet(Dell, ipad)	30,000
TOTAL	6,67,000

4. THE COST OF SIMILAR IMPORTED DEVICES:

Requirements Needed	No of Quantity
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DJI Agras MG-1S (Agricultural drone)	8,40,000
DJI Matrix 600 pro	3,06,000
TOTAL	11,46,000

5. PRODUCTION AGENCY / INDUSTRY:

(Please see page 3 of General Information. Please annex willingness/commitment from the production agency to undertake production of device after development and commitment for their contribution for the project).

6. REVIEW OF STATUS AND TECHNOLOGY TRENDS IN RESPECT OF DEVICE / INSTRUMENT TO BE TAKEN UP FOR DEVELOPMENT:

a) International status of development.

Internationally, drones are developing at a greater and advanced level. Every drone has its own purpose over each sector. AI techniques has been implemented a lot and making revolution in drone technology abroad.

b) Current status in our country.

Currently, India is still under development of AI implemented advanced drone technology for various sectors. As per the data, most of the drones are bought from other countries, imported and used for various purposes.

c) Status in your organization/Review of expertise available with proposed investigating group in the subject of the project.

d) Gaps to be covered through proposed work with special reference to the proposal.

The drone designed by us is to provide the use of a single drone for multipurpose use, in the sense, this drone can be implemented to use in various sectors for various purposes such as agriculture, dam maintenance, power line inspection, oil spill detection, defense and many other fields.

The cost of a single purpose drone may range from 35000 rupees – 10 lakhs. For e.g. An advanced agricultural drone only may cost around 3-5lakhs. So, the main aim of our project is to reduce the cost of production of the drone and to provide the use of same drone for various purpose rather than a single purpose.

7. TECHNICAL DETAILS:

a) Features of the device/instrument proposed to be taken up for development.

- **THERMAL IMAGING CAMERA** – scans the area to be focused and produces a thermal image according to which survey can be done using the temperature difference in different regions. It uses mid or long wavelength.
- **LiDAR** – Light Detection And Ranging is a main instrument of a drone system. It uses remote sensing technology using the light emitted in the form of pulse. LiDAR is used for various purposes like 3D mapping, obstacle detection, crash prevention, water management in agriculture.
- **CAMERA** – Camera is used to capture images or real time video of the area focused. The other main purpose of the camera is to drive the drone from the place of takeoff, this type can be termed as FPV (First Person View). Other cameras placed on the drone are used for sensing of data and also can be used for 3D mapping.
- **IR CAMERA** – IR camera is used for many purposes like flying drone at night time, to detect the oil spillage in seas or industries and other such purposes. It uses short wavelength.
- **SPECTROMETER** – During flying of drone nearly high voltage power line, there is a change of damage to electronic components of drone due to electromagnetic energy. So to find out the safety range of it, spectrometer is used.
- **SPRAYER** – Sprayer is used for agricultural purpose to spray the pesticides and fertilizers in the agricultural land and also at the desired location after prediction of area of pest or nutrient deficiency.

b) Specifications.

Equipment Name	Specification
Frame	Hexa-Copter
BLDC motor	6 x 150 KV motor (4 spare)
Flight Controller	DJI A3
Li-po	2 x 4s 12000mah
Transmitter and receiver	Jeti Duplex transmitter and receiver
Propeller	6 x 10 inch (14 spare)
Cameras and Gimbals	IR Thermal and Visible
Telemetry	433MHz or 915MHz

Range Booster	20 km
GPS	DJI branded
Instrument payload	IR Thermal, Visible cam, Sprayer, Spectrometer, LiDAR
Range	approximately 10km
Flight time	appx. 40 mins
RF signal	2.4GHz
Video RF signal	5.8GHz
Weight	Appx. 5kg
Payload weight	10kg

- c) **Please make a comparison of the system taken up for development with similar products if available in international market indicating similarities of differences.**

The major difference between the commercially available product and the proposed design would be the ease of the effectiveness of suitability with all the fields in our daily life starting from agriculture, going through industrial, security service, search & rescue up to defense. The other major and important difference would be the cost effectiveness of the proposed design which would be much lesser than the present-day commercial product around the world. All other things and differences depend upon the components which we would be using in our project.

- d) **Description of various techniques and reasons for choosing the particular technique of measurement.**

Recent technology has been improving a great height all over the world. In those technologies, one such very important technology is drone. In India, drone technology is still under research and study. Drones can be implemented for variety of usages in our daily life and it plays a major role in it. Especially, the drone will be much useful for farmers to easily predict the areas of infection, disease and pest. It can also provide those data such as plant growth rate, gross profit or loss, monthly calculation of growth of plants and many more. And all these are done with the help of Artificial Intelligence. Not only for agriculture, but the proposed design will be able to serve in all other fields such as Dam inspection, Power line inspection,

Mining, 3D mapping, Videography, Security services, Defense, transport service such as First aid kit delivery during emergency conditions and also for Search and Rescue. The usage of drone has now become never ending technology and it would be the reason for choosing it.

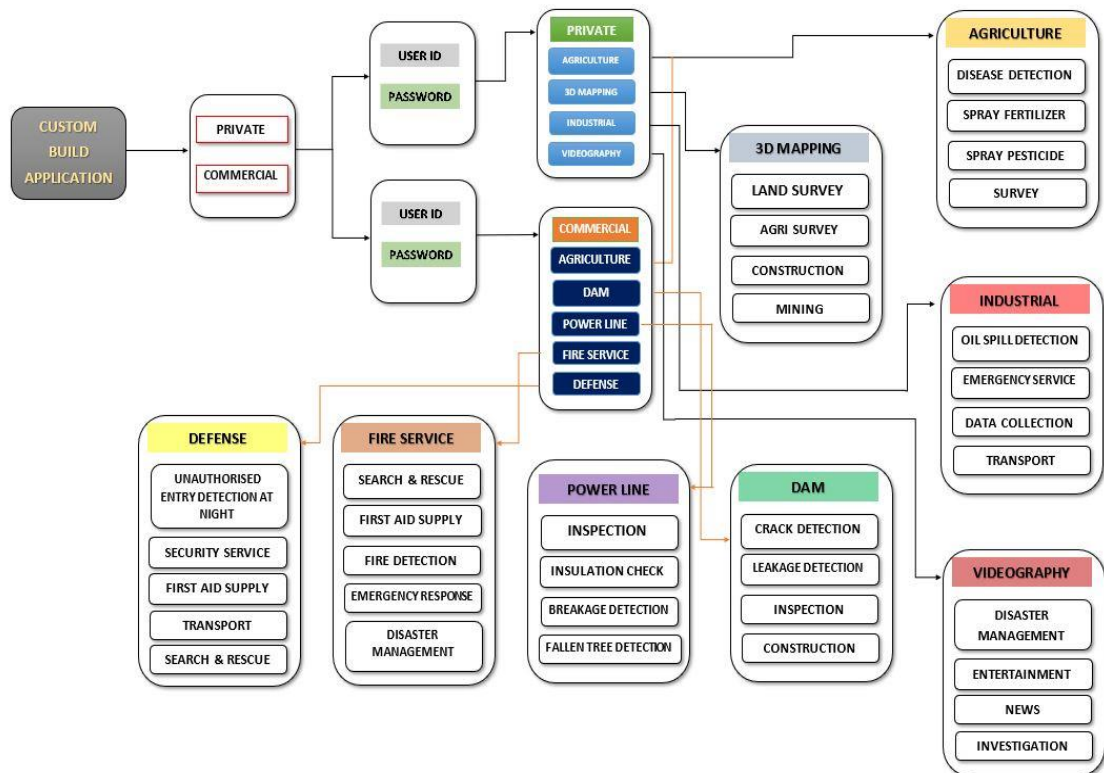
e) Principle or operation.

The main principle of this project proposal is to serve technology for the ease of work in various fields in our daily life. This can be achieved with one of the trending technologies in our day to day life and that is, the drone technology. The project is planned to be a multipurpose drone to provide its capability to solve the works in multiple fields of our society which is facing various problems every day.

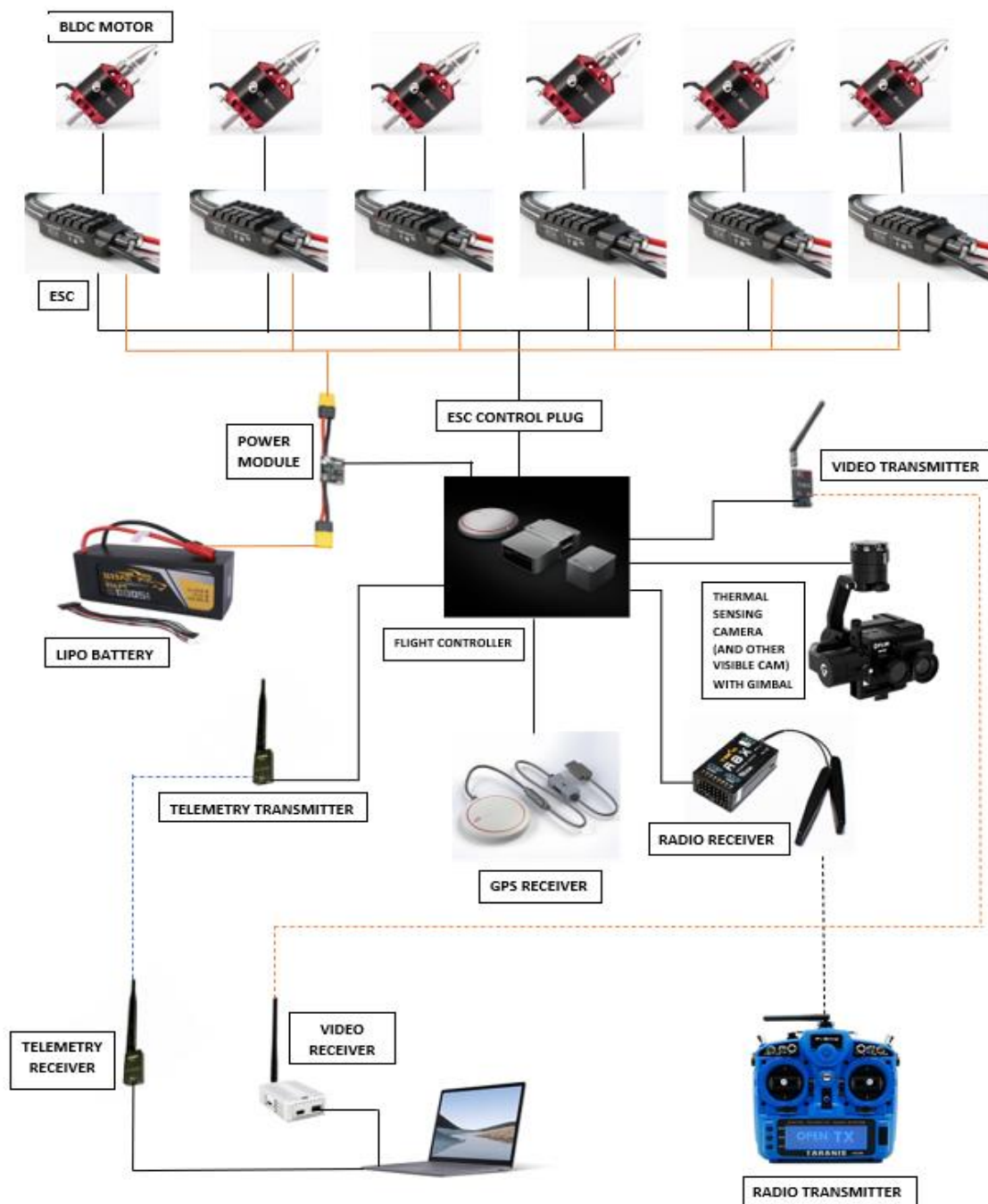
f) Engineering Design of device/instrument

The drone design has the framework of hexacopter. The hexacopter has six hands fitted with 6 brushless outrunners and propellers. These brushless motors are controlled by 6 Electronic Speed Controllers (ESC) each. These ESCs controls the speed and pitch of the drone. They all are connected to the brain of the hexacopter called, the FC or Flight Controller which controls the stabilization and movement of the drone. All these components are powered up with 12000mah 3s battery. Telemetry is used to know the conditions of the drone such as GPS position, altitude, battery status and more. As this is a multipurpose drone, it uses various instruments for various purposes. Some of them are IR thermal imaging sensor, high resolution camera, spectrometer, pesticide/fertilizer sprayer, LiDAR and etc.

g) Block/schematic/circuit diagram:

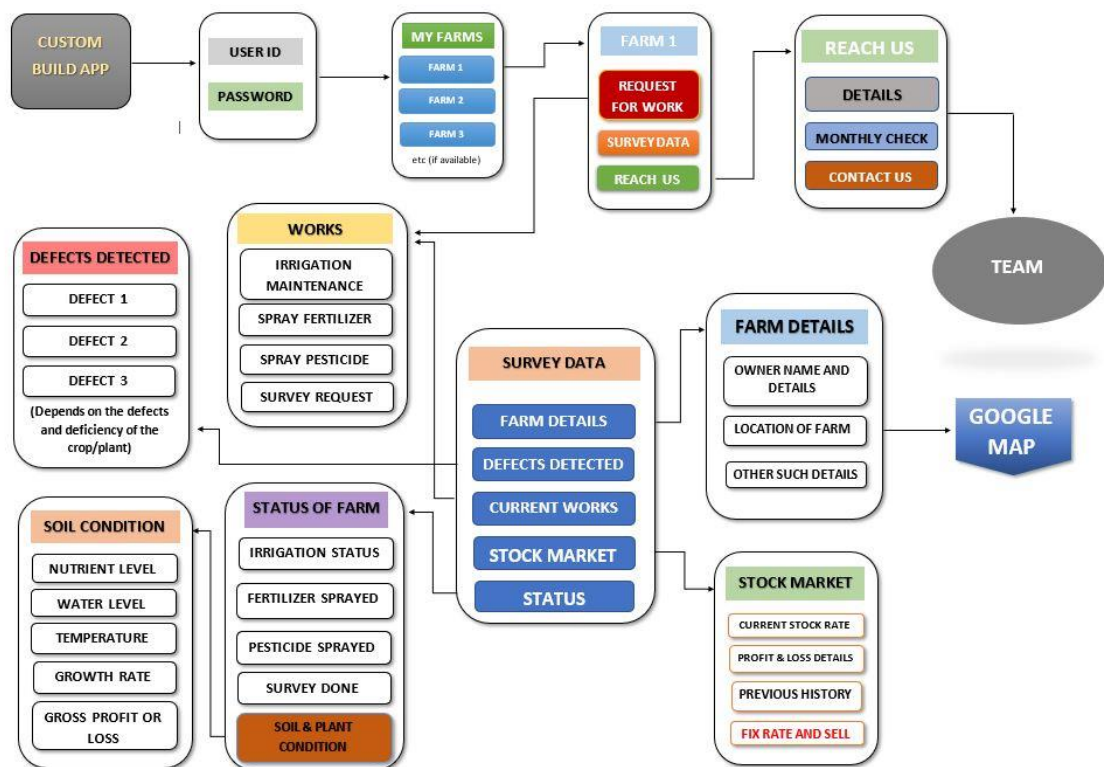


BASIC ARCHITECTURE DIAGRAM OF CUSTOM BUILD APPLICATION
WIRING DIAGRAM OF THE DRONE



----- → wireless connection

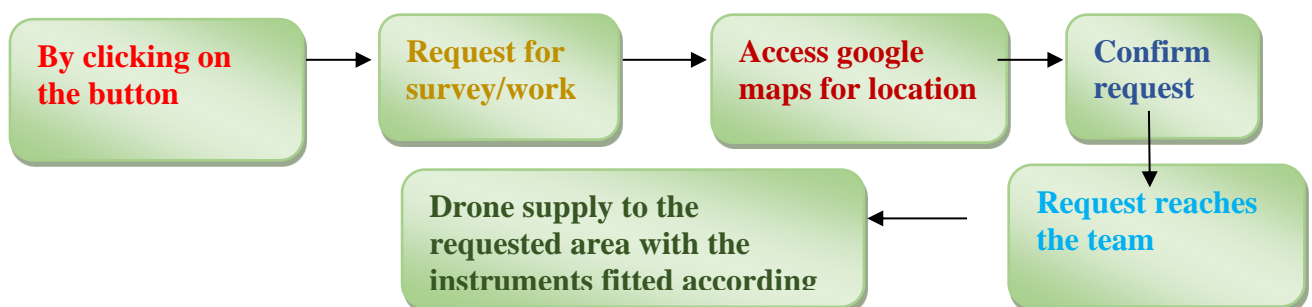
ADVANCED ARCHITECTURE EXAMPLE FOR AGRICULTURE

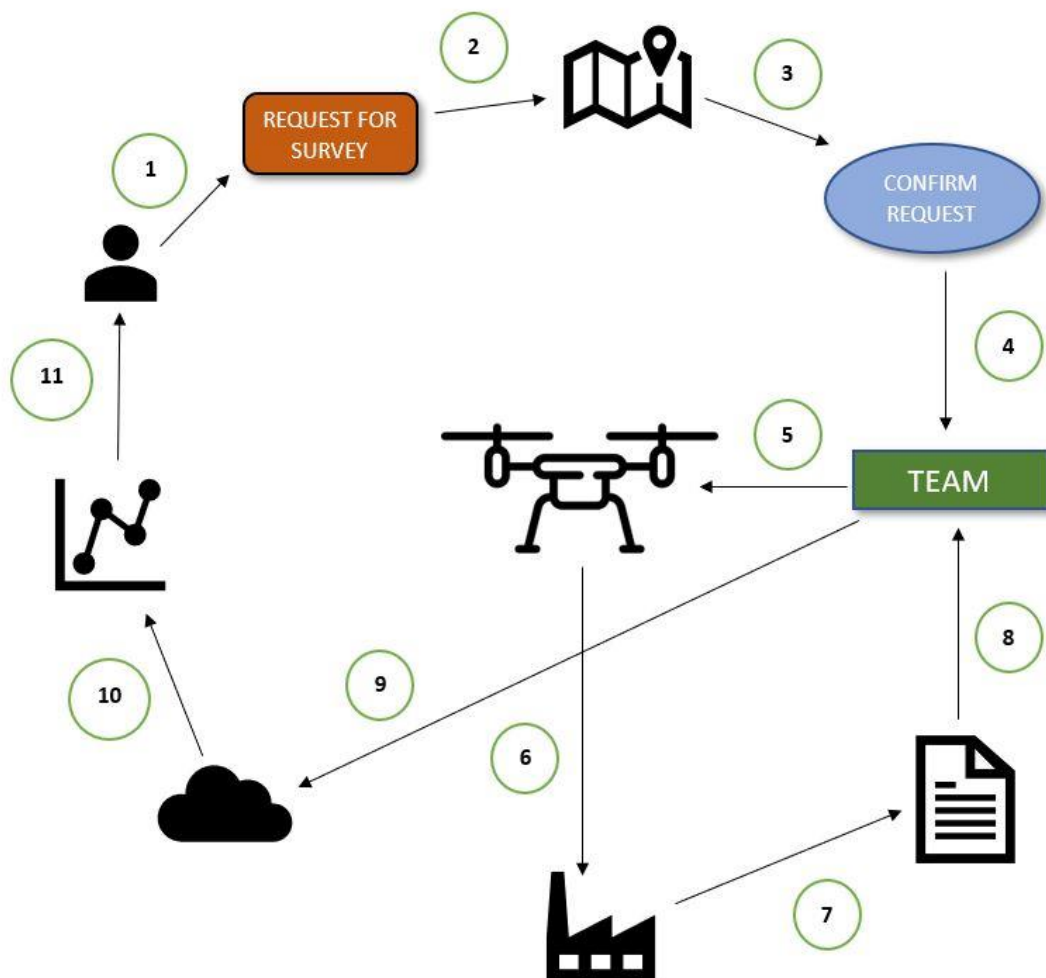


h) Description of various sub-systems etc.

i) How calibration, standardization, testing etc. will be achieved? (Please describe in brief procedures/methods for these).

(Please give references wherever applicable).





8. WORK PLAN:

Methodology:

Simulation of the Product:

During the first 6 months tenure, the project designing and simulation takes place. Selection of best hexa frame for the perfect need of our project and designing the drone with equipment and testing it with simulation to calculate its durability and functions.

Construction of Product:

After the instruments and equipment are ordered online and when imported, construction of the drone will be started. All the connections will be done as per the schematic diagram and primary test will be done in the field to test its performance.

Building the application:

The application plays a major role in our project development. All the raw data collected from the drone during survey are fed into this application to find out the defects in the field of respective area using the Artificial Intelligence

technology and the processed data will be uploaded into the cloud for later use by the end user using IoT platform.

Incorporating the custom build app with the product:

The custom build application will now be tested with the raw data collected by the drone survey to find the accuracy of the application working with AI. The thermal images fed into the application will be analyzed by the already trained AI system and provides us the accurate result. Which is then uploaded into the cloud server for testing how it works with the end user.

Research and Development:

The product will be thoroughly analyzed for the perfection of the working system. If there is any default will be rectified and will be developed with the best system which is suitable for it.

Final testing and implementation test in various fields:

Finally, the real testing of the product comes. All the application system and the drone will be tested on the site of the fields such as agriculture, power line, dam, and other such fields. The resultant data will be analyzed for its accuracy and perfection and it will be checked with the real end user for the ease of information of the application and the product, based on which further updates and development will be done to bring it out as a finalized product.

a) Time schedule of activities:

Please give bar chart indicating important activities and time duration from start to end:

6 months: Simulation of the product

6-12 months: Construction of product

2nd Year- 6 months: Building the application

6-12months: Incorporating the custom build application with the product

3rd Year- 6 months: Research and Development

6-12 months: Final Testing and implementation test in various fields

