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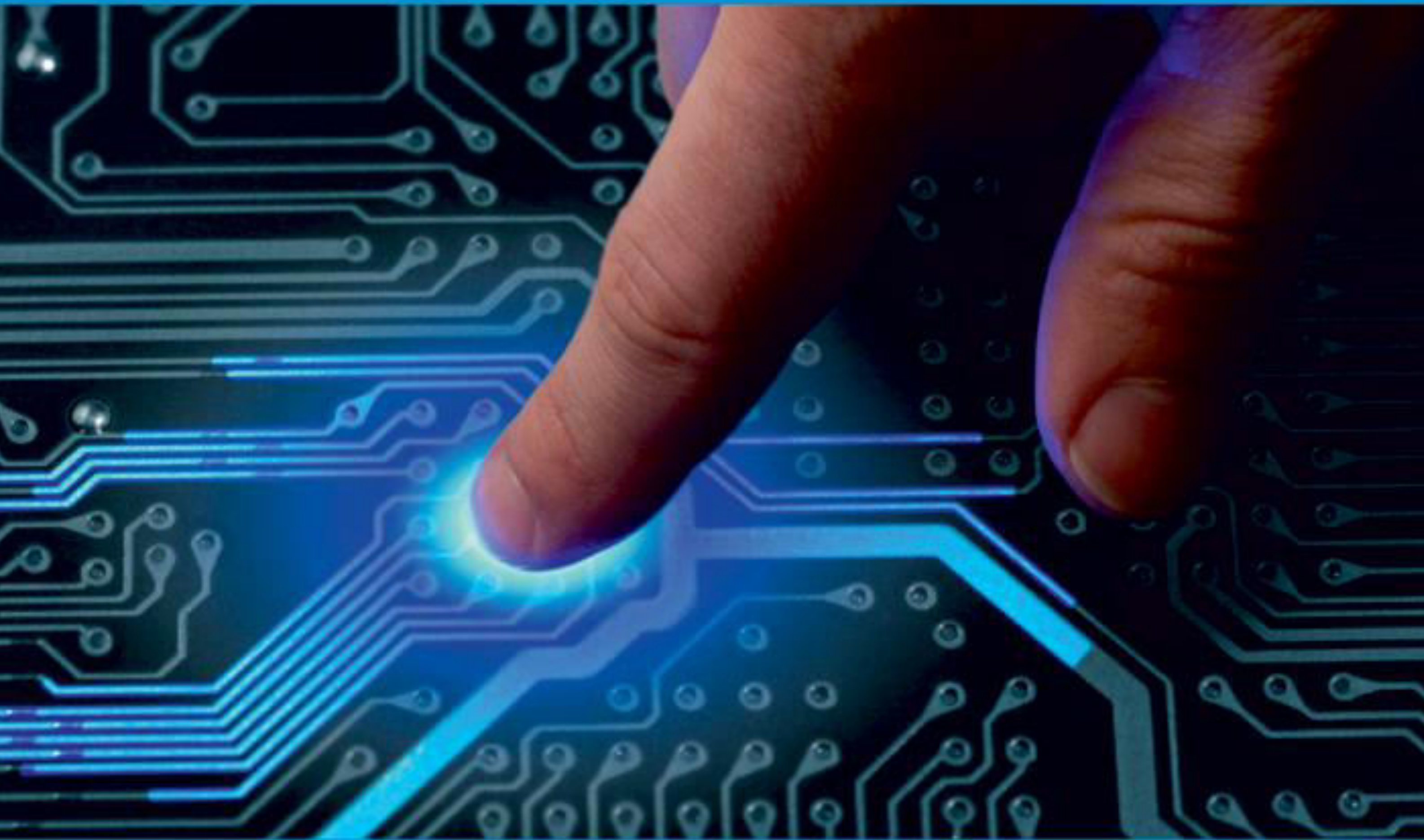

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24/7 Aerial Surveillance Vision by Drone with Human Detection

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ABSTRACT: This is an overview that endorses the establishment of a Drone that can be only used by the Military and Security Forces of a Country in remote areas for 24/7 surveillance where it is difficult for them to reach. It is a project based on a Drone that will have 24/7 battery backup and it can fly as well as function like a satellite. Similar to a satellite, the Drone will fly around a particular orbit which can also be selected by the control room. It will have the ability to scan human beings and detect weapons if any. Also, it will broadcast live footage and information to the control room. Basically, it will be used to prevent Smuggling, Human Trafficking, and other illegal activities. If any person having no access to the drone receives it and tries to get access then, the Drone's "Self-Destruction" mode will get activated, and immediately it will destroy so that, no one can get any information from it.

KEYWORDS: 24/7 Battery Backup Drone, UAV Drone, Human Detection, Weapon detection, Self-destruction features in drone, surveillance drone, and Wireless charging in a drone.

I. INTRODUCTION

Unmanned Aerial Vehicles (UAVs), also known as drones, have become increasingly popular over the last decade due to their versatility and wide range of applications. UAVs are remote-controlled aircraft that can be used for a variety of purposes, including military reconnaissance, aerial photography, search and rescue operations, and surveying. One type of UAV that has gained significant attention in recent years is the hexacopter, a multirotor drone with six rotors. Hexacopters are known for their stability, maneuverability, and ability to carry heavy payloads, making them ideal for a range of applications. In this paper, we will explore the capabilities and applications of UAVs in general, and hexacopters in particular, as well as the design considerations that must be taken into account when building and operating these devices. We will also discuss the current state of the art in hexacopter technology and explore potential future developments in this field.

Surveillance has become an increasingly important aspect of modern society, with the need for advanced monitoring technologies rising in various fields. Unmanned Aerial Vehicles (UAVs) and hexacopters, in particular, have emerged as key tools for surveillance due to their agility, versatility, and ability to operate in difficult-to-reach areas. The use of UAVs and hexacopters in surveillance has revolutionized the way security is monitored, allowing for enhanced situational awareness and the ability to gather critical information in real-time. In this paper, we will explore the various applications of UAVs and hexacopters in surveillance, including border security, law enforcement, and environmental monitoring. We will also discuss the technological advancements that have made these devices more accessible and effective, including advanced sensors, cameras, and data processing software. Additionally, we will address the legal and ethical concerns associated with the use of UAVs and hexacopters for surveillance purposes, and the potential impact on privacy and civil liberties. By examining the current state of the art and potential future

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developments, we hope to provide insight into the role that UAVs and hexacopters can play in enhancing surveillance capabilities across a variety of fields.

II. RELATED WORK

Motion detection is a reliable method for human detection in videos, particularly for moving frames. The video is processed using MATLAB IDE to recognize human presence and assign a confidence score. The resolution is reduced, and an area of interest is chosen to reduce processing time. Kalman filtering is used to detect and track moving humans in each frame, with lost tracks deleted and new ones created. A confidence score is also assigned to each detection. [1]
However, our project aims to achieve live-time human detection by utilizing a high-definition camera and a passive infrared sensor to scan the location. This will enable us to detect the weapons carried by humans, making the detection process more effective.

The proposed drone security module includes a secure element (SE) and a microcontroller unit (MCU) that encrypts and decrypts UAV communication and storage data. The MCU communicates with the flight control computer, mission computer, or communication device via USB and with the SE using an ISO7816 or SPI interface. The SE chip includes specific crypto hardware, secure memory for storing encryption key and secret data, and a Common Criteria EAL5+ (CC EAL5+) class hardware chip. It also includes a kernel layer and an application layer that enables various cryptographic functions. The drone security module stores multiple encryption keys, HMAC keys, and key pairs for public-key cryptography. It also includes a storage space for a certificate key pair and certificate, which can be used for public key-based cryptographic operations. [2]
Our drone will have the self-destruction mode. Once the drone will come in touch with any unauthorized person and they tried to access it then automatically self-destruction mode will be activated and the drone will destroy. On the other, high-level level data security will be used during the live data transmission.

Wireless Charging of an Autonomous Drone
The author of this paper presents an efficient wireless power transfer (WPT) system for the autonomous charging of drones. This allows for complete drone autonomy and eliminates the need for human intervention. To achieve this, a dedicated high-frequency inverter (100 kHz) is designed to connect the PV system to the wireless power transfer system and Litz wire transmission coils, which can operate at the high frequency where grid power is not required. Each off-grid location can be equipped with a solar-powered wireless charger, making the inspection process more convenient [3].
In our project, we plan to use highly powerful solar cells covering the entire upper surface of the drone's body for charging. We will also implement a wireless charging tower at the drone's orbit or path location. Once the drone enters the tower's frequency range, it will start to charge.

The unmanned aerial vehicle (UAV) system is equipped with a video capture and a georeferencing module. The video capture module comprises an athermal camera and an optical camera, while the georeferencing module utilizes the UA V's built-in GPS and ArduPilot Mega. The video feed and GPS data acquired by these modules are transmitted using three transmitter and receiver pairs, two of which use a 5.8 GHz frequency band, and the other uses a 2.4 GHz frequency. The system utilizes two modes of surveillance: thermal sensing to detect regions of human-body temperature and optical scanning to aid in scanning the area for human prospects. The raw image data from the thermal sensor requires pre-processing techniques such as background approximation and filter techniques to improve the contrast of the processed image, emphasizing human-shaped figures in the thermal image. Segmentation and thresholding are performed on the image, leaving only the shapes of interest behind. Target detection is achieved using a cascade of boosted classifiers working with Haar-like features and local binary patterns for thermal and optical detection, respectively. Initial calibration is done to set the reference parameters, including the coordinates, altitude, and compass heading, which are fed into Matlab through serial communication. The triangulation method is used to determine the location of the potential human being, and the computed latitude and longitude coordinates are plotted over Google Maps using Matlab's built-in functions. [4]

The WPT system transfers power wirelessly using electromagnetic induction. It includes a high-frequency inverter, compensation network, transmission and receiver coils made of Litz wire on a ferrite core, and a rectification circuit. The system charges a drone's LiPo battery and is connected to a microcontroller with ZigBee communication. The drone is a Quadcopter with a carbon fiber chassis, RS2205 2300KV BLDC motors, Lumenier LUX F7 flight controller, ESCs delivering 60A output, and a 1500mAh, three-cell battery for a flight time of approximately 13 minutes. [5]

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In our project, we will use highly powerful solar cells on the upper surface of the drone, that will help to get charge in the daytime.

The use of drones for remote object detection and localization in crime scenes has become increasingly popular due to the advancement of technology. One of the most effective techniques used in this approach is Multi-Perspective Object Detection (MPOD). This technique utilizes multiple cameras and sensors mounted on drones to capture various perspectives of a crime scene, which improves the accuracy of object detection and localization. The paper introduces an intelligent system that implements MPOD for detecting remote criminals and localizing objects in crime scenes. This system offers the advantages of preserving the crime scene without disturbing the evidence and covering a large area quickly. Overall, the system is an innovative solution that enhances the effectiveness of crime scene investigation.[6].
Our project aims to implement object detection by utilizing sensors to scan for concealed weapons in humans.
Autonomous control to detect humans mounted on Drone.

This paper describes the development of an automated human detection system mounted on a drone that can provide rescuers with essential data needed for effective rescue missions. The system assigns a score of confidence for each human detection, aiding in the creation of an action plan for the rescue operation [7].

This system can significantly reduce the time spent on developing an action plan, increasing the survival rate of the victims [8].
Our future research aims to enhance the rate of human detection by incorporating cost-effective sensors and conducting statistical studies on the same.
The detection of weapons and scanning of individuals is an important aspect of security, and one of the methods used is the Terahertz sensor. Terahertz radiation is capable of penetrating fabrics and plastics, making it useful for surveillance and security screening. It can detect concealed weapons remotely by penetrating many non-metallic materials, such as paper, cloth, and leather. Imaging detection systems utilizing Terahertz waves are suitable for concealed weapon detection.
However, accurately distinguishing handguns, knives, or bomb belts from everyday objects such as cell phones, pens, and watches is a significant challenge for current THz imaging technologies. High-resolution images are required to achieve this, which is difficult to achieve. Our objective is to investigate and develop the fundamentals of a handheld THz imager for concealed weapon detection, which would enable high-resolution images and reliable weapon detection.[9]

III. DATA SOURCE

3.1 Catia V5 Software:

Building a hexacopter using Catia V5 software can be broken down into several steps.
Define the Hexacopter: Start by defining the specifications of the hexacopter you want to build, including its dimensions, weight, payload capacity, and desired flight time.
Create a 3D Model: Using Catia V5 software, create a 3D model of the hexacopter, including its frame, arms, motors, propellers, landing gear, and any other components you want to include.
Add details: Once you have the basic 3D model, add details such as wire routing, battery placement, and component mounting.
Simulate the Flight: Use Catia V5 software to simulate the flight of the hexacopter. You can use this simulation to test the design and make any necessary adjustments.
Export the Design: Once the design is complete, export the 3D model as an STL file for 3D printing or CNC machining.
Assemble the Hexacopter: Use the exported 3D model to assemble the hexacopter by 3D printing or CNC machining the components, and then assembling them according to the design.
Test Flight: Once the hexacopter is assembled, test fly it to make sure it is working as expected. If necessary, make any adjustments to the design and repeat the process until the hexacopter is working correctly.
It is important to note that building a hexacopter requires knowledge and experience in both Catia V5 software and drone building. It is recommended to seek guidance from an experienced designer or engineer to ensure a safe and functional hexacopter is built.

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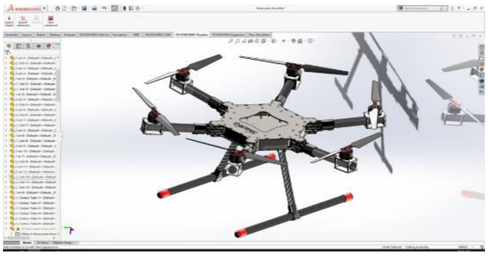

Fig3.1: Design Hexacopter in Catia v5 software

3.2 MSC Nastran patron:

MSC Nastran is a powerful Finite Element Analysis (FEA) software that can be used for structural analysis of mechanical systems, including hexacopters. Here are the general steps to use MSC Nastran for building a hexacopter:

Define the geometry: Create a 3D model of the hexacopter in a CAD software and export it as a neutral file format that can be imported into MSC Nastran, such as IGES or STEP. This model should include all the major components of the hexacopter, such as the frame, motors, propellers, landing gear, and any other structural elements.

Create the mesh: Once the geometry is imported, create a mesh by dividing the model into smaller elements. The mesh should be fine enough to capture the details of the geometry and structural features of the hexacopter. Use appropriate meshing techniques, such as solid elements, shell elements, or beam elements depending on the part being meshed.

Define the materials: Assign appropriate material properties to each element of the mesh. Common materials used in hexacopters include aluminum alloys, carbon fiber, and plastics. Use appropriate material models that accurately represent the material behavior under various loading conditions.

Define the loads and boundary conditions: Define the loads and boundary conditions that the hexacopter will experience during operation. These loads can include the weight of the hexacopter, the thrust generated by the motors and propellers, and any external forces such as wind. The boundary conditions can include fixed supports for the landing gear and motor mounts, as well as any constraints on the motion of the hexacopter.

Run the analysis: Once the model, mesh, materials, loads, and boundary conditions are defined, run the analysis in MSC Nastran. The software will solve the equations of motion for the hexacopter under the defined loads and boundary conditions, and generate results such as stress, deformation, and displacement.

Interpret the results: Analyze the results to identify any areas of high stress or deformation that may cause failure of the hexacopter. Make any necessary changes to the geometry, material properties, or loads to improve the performance and durability of the hexacopter.

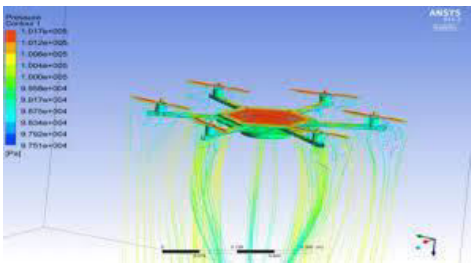

Fig3.2: Simulation Hexacopter in MSC Nastran Patron

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3.3 MATLAB:

MATLAB is a powerful tool that can be used for designing and simulating drones. Here are the general steps to build a drone using MATLAB:

Define the specifications and requirements for your drone, such as weight, size, payload capacity, flight time, and range.Model the drone in MATLAB using the Aerospace Blockset or Simulink. You can choose from different drone configurations, such as quadcopter or hexacopter, and design the frame, motors, propellers, battery, sensors, and other components.Simulate the drone's dynamics and control system to evaluate its performance and stability. You can use the Simulink model to simulate different flight scenarios, such as hovering, takeoff, landing, and maneuvers, and analyze the response of the drone to different inputs and disturbances.Implement the control algorithms for your drone, such as PID or LQR, using MATLAB functions and Simulink blocks. You can design the control system based on the drone's sensors, such as accelerometer, gyroscope, magnetometer, GPS, and camera, and optimize the controller parameters for better performance.Generate code for your drone's control system using Simulink Coder or MATLAB Coder, and deploy it on the drone's onboard computer or microcontroller. You can also use MATLAB to interface with the drone's sensors and actuators through wireless communication protocols, such as Wi-Fi, Bluetooth, or Zigbee.Test and validate the drone's functionality and performance in real-world conditions, such as outdoor or indoor environments. You can use MATLAB to analyze the drone's flight data, such as altitude, speed, orientation, and battery level, and improve the control system based on the feedback.Overall, using MATLAB for drone design and control allows you to have a powerful toolset for simulation, control design, and code generation, and can help you build a reliable and efficient drone.

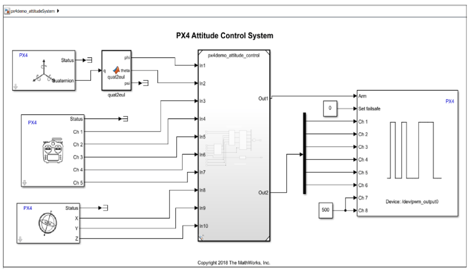

Fig3.3: Hexacopter Parts Design in MATLAB

IV.METHODOLOGY AND FRAMEWORKS

Basically, surveillance is an act of monitoring the activities of any group, people, place, things, etc. with the intention of managing, influencing, directing, or protecting. There are many methods are used for surveillance. GPS tracking, data mining, camera surveillance, profiling, and biometric surveillance are the major methods which are frequently used for surveillance.
However, traditional observational surveillance methods have limitations due to the stationary nature of the camera, making it necessary to handle it manually or mount it on a tripod or structure. Aerial surveillance using helicopters can achieve the desired results but can be expensive.
Unmanned aircraft systems (UAS) provide a more accessible, faster, and cost-effective solution to the limitations of other surveillance methods. Drone surveillance can collect data more efficiently and inexpensively. They can capture imagery beyond the range of human eyes.
UAVs can cover large and remote areas quickly, reducing the number of personnel required and operational costs. The performance results of UAVs depend on the definition of correct detection results. Hence, we propose three evaluation approaches: frame-based, location-based, and time-based, to consider classification, location, and detection delay, respectively.

A. Human Scanning and weapon detection.

The Passive Infrared (PIR) sensor is used to detect the presence of a human. So, we will use this sensor to detect humans. By using a High-Definition camera, we will scan the location as well as humans to get video-based live information. And by the PIR sensor, we will detect humans easily. Guns can be easily detected by the infrared sensor camera but the wide variations of gun models can pose a challenging task to the surveillance system leading to false alarms.

Imaging: A drone can use cameras and sensors to capture images of the target area and individuals. These images can then be processed using computer vision algorithms to identify weapons, such as guns or knives, based on their shapes, sizes, and other visual characteristics.

Thermal scanning: Drones equipped with thermal imaging cameras can detect the heat signatures of objects, including weapons. This can be particularly useful in detecting concealed weapons, as the heat emitted by a person carrying a weapon may differ from that of a person who is not.

Radiofrequency (RF) detection: Drones can use RF sensors to detect the presence of electronic devices, such as cell phones or radios, which may be associated with the use of weapons.

Machine learning: Drones can be trained using machine learning algorithms to recognize patterns associated with the presence of weapons. This can involve analyzing data from previous scans to identify common characteristics associated with the presence of weapons.

B. Own orbit to fly

A drone can fly in a particular orbital direction by using GPS through a process called "waypoint navigation". This involves pre-programming the drone's flight path using GPS coordinates and specific commands that direct the drone to fly along a specific route or orbit.

To fly in a particular orbital direction, the drone's GPS system must be able to receive and interpret signals from multiple satellites to determine its precise location and orientation in space. Once the drone's location is determined, it can then follow the pre-programmed flight path, adjusting its altitude and orientation as necessary to maintain the desired orbit.

The flight path can be programmed using specialized software or through manual input by the drone operator. The operator can specify the altitude, speed, and direction of the orbit, as well as any other waypoints or points of interest along the flight path.

During the flight, the drone's GPS system continuously tracks its location and compares it to the pre-programmed flight path, making any necessary adjustments to ensure that it stays on course. This allows the drone to maintain a consistent and precise orbit in the desired direction, even in windy or other challenging conditions.

Overall, GPS technology plays a crucial role in enabling drones to fly in specific orbital directions, allowing them to perform a wide range of tasks from aerial photography to surveying and mapping.
It can fly in its own orbit or path similar to a satellite. It will revolve in its orbit 24/7. The control room can set the orbit manually as well. By using GPS that particular orbit or path can be selected and the way to fly also. Using GPS we will set a route map where by following the particular route map ASV drone will fly and move continuously.

C. Self-destruction mode

When our drone comes in contact with anyone who doesn't have access to it and tries to get access, then immediately self-destruction mode will get activated and the drone will get destroyed. To ensure these features we will implement one small touch sensitivity fingerprint sensor to detect the fingerprint of any person and also when anyone wants to get access then the security system gives the signal automatically. When this signal will pass through the circuit then inside the circuit some electrical short circuit will be generated and all the circuit parts will be destroyed. We will also implement a system where if anyone wants to hack the drone and cut the transmission signal then it will follow the same destruction mode command.
Implementing a self-destruction system in a drone can be a complex and potentially dangerous process, so it should only be attempted by trained professionals with experience in drone security.
Here are some general steps that could be taken to implement a self-destruction system in a drone to prevent unauthorized access:

Identify the trigger: Determine what events should trigger the self-destruction system, such as attempts to hack the drone's control systems or tamper with its hardware.
Install sensors: Install sensors or other detection mechanisms that can detect the triggering events. For example, you could use a combination of GPS and motion sensors to detect if the drone has been taken out of its designated area without authorization.

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Write code: Develop code that can recognize the triggering events and activate the self-destruction system. This code should be designed to be tamper-proof and resistant to hacking attempts.
Install the self-destruction mechanism: Install a mechanism that can physically destroy the drone when the self-destruction system is activated. This could involve detonating explosives or triggering a mechanism that physically damages the drone's critical components.

Test the system: Test the self-destruction system thoroughly to ensure that it works as intended and is not triggered accidentally. Make sure to follow all safety protocols during testing.
Secure the system: Finally, secure the system so that it cannot be easily disabled or circumvented by unauthorized users. This may involve encrypting the code, using secure authentication methods, and implementing other security measures to prevent unauthorized access.

D. Wireless Charging Tower

A wireless charging tower will be used for charging drones at night time. In the route of the drone orbit or path, after a particular distance, a wireless charging tower will be built. The tower will create a wireless frequency on the path of the drone and when the drone will come in this frequency then the drone will get start charging automatically.
Wireless charging towers use electromagnetic induction to transfer energy from the charging tower to the flying drone wirelessly. This process involves the creation of a magnetic field by the charging tower, which induces a current in a coil in the drone. The induced current is then used to charge the drone's battery.

The charging tower generates an alternating current (AC) in a coil, which creates a magnetic field that oscillates at a specific frequency. This frequency is known as the resonant frequency or maker charge frequency. When the drone is brought into proximity with the charging tower, the magnetic field induces an alternating current in a coil in the drone, which charges the drone's battery.

The resonant frequency or maker charge frequency is important because it allows the energy to be transferred wirelessly over a distance without significant loss. When the frequency of the magnetic field matches the resonant frequency of the coil in the drone, it induces a strong current in the coil and transfers a significant amount of energy. This process is known as resonant coupling.

To charge wirelessly, the drone must be equipped with a coil that is tuned to the same resonant frequency as the charging tower. The coil in the drone is connected to a rectifier circuit, which converts the alternating current induced by the magnetic field into direct current (DC) to charge the drone's battery.

V. PROPOSED SYSTEM

In the proposed system we will implement all the features that come with a new and unique idea in a smart formation. We will make the drone compact as much as possible with all the important required sensors.

A. Architectural Block Diagram

The flow of the below diagram is connected to all the sensors and the required equipment with the processor. When any sensor detects something then, it will release the signal and the receiver will receive the signal and the display will show the result. Using a Wi-Fi module it will share the live video footage as well as all the live information with the receiver. The control room will receive the signal as well as information.

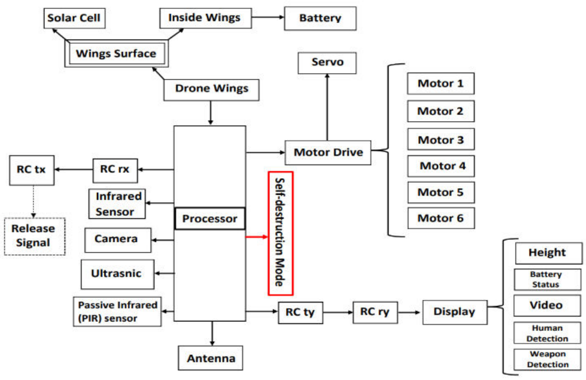

Fig 5.1: Architectural Block Diagram

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B. Orbital Structure / Map Route

This is the workflow as well as orbital structure of the drone. Using GPS the way or route map of the drone can be selected. The drone will fly in that particular route or way which has selected by the control rooms. This way can selected manually and if operator wants to stop the drone at any particular point then its possible to stop. On the selected way, the drone will move continuously. While moving it will capture live video, Scanning result and it will able to send all the information to the control room live time.

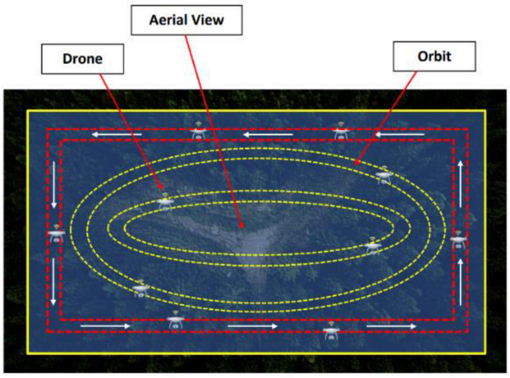

Fig 5.2: Orbital Structure

C. Information Transmission

This is the work flow and information transmission architecture of our ASV drone. In the time of moving on a particular orbit or way, the drone will scan the area continuously and it will detect human. Once it will detect any human then it will scan the human and detect for, weather they are having any weapon or not. If the drone will detect any weapon are having the human then it will pass the alert signal immediately. The drone also send all the live information along with live video footage to the control rooms. From the monitoring station the operation can be able to operate the drone and the operator will see all the information passed by the drone.

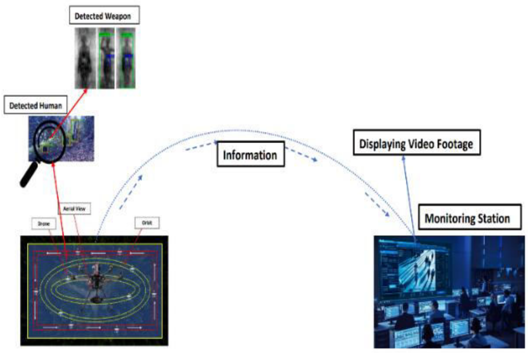

Fig5.3: Information Transmission

D.Wireless Charging

This is the diagram represent the entire wireless charging system of the drone. Wireless charging tower will create a wireless charging radius. Once the drone will come near the charging tower and enter the radius of the charging frequency then, the drone will starts charging automatically. After a particular distance tower will be implemented. And the tower will be implemented on the way of the drone moving or the orbit of the drone. So that, in the time of moving when the drone will come near the tower it can get charged. By this system's circulation the hole night time drone will get battery backup.

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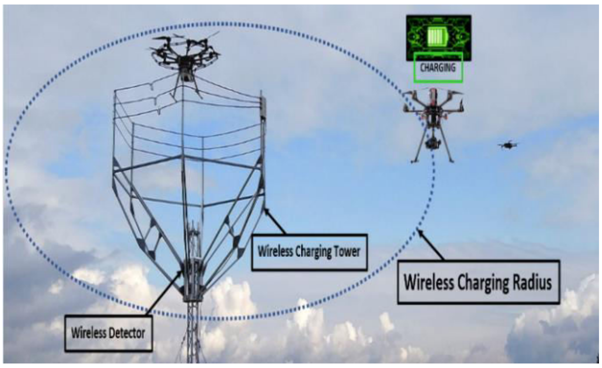

Fig5.4: Wireless Charging

VI. CONCLUSION

There is an abundance of evidence that demonstrates the value of drones as a widely used technology for collecting spatial and operational data to support humanitarian operations. Drone surveillance provides a more efficient, speedy, and cost-effective method of data collection. Additionally, there are several other key advantages to using drone planes, such as their ability to enter narrow and confined spaces, their minimal noise output, and their equipped night-vision cameras and thermal sensors, which can provide imagery that is beyond human visual capabilities.

The surveillance drone is an essential technological system in many situations for ensuring the safety of goods and people, owing to its speed of deployment and its precise observation capabilities.
Aerial surveillance drones are an efficient and cost-effective alternative to helicopters and static cameras. They can scan and detect illegal activities and provide thorough information, making them a decisive operational asset during surveillance missions.

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