

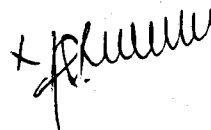
ABSTRACT OF THE INVENTION

The visual inspection of Tele-Communication (TC) tower members, tower connections, antennas, antenna mountings, corrosion and erosion of structural components, missing of bolt and nuts, must be carried out periodically to avoid major problems. The conventional manual inspection is tedious because one has to climb the overhead structures and the risk of human life is a major problem. The human piloted helicopter system is expensive and prone to accidents. The proposed Multi-rotor Unmanned Aerial Vehicle (MUAV) system will overcome these difficulties which can inspect the telecom tower with an aid HD and IR cameras. In addition, measurement of Electromagnetic radiation at different altitude and latitude levels is achieved through an Electromog meter embedded in the MUAV system. The corrosion and erosion of tower members are inspected with an aid of specific instruments and also image processing techniques. The on-board microcontroller with IMU and GPS module would stabilize the vehicle for Hovering.

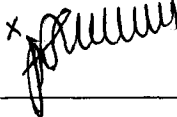
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CLAIMS

1. Multirotor UAV telecom tower inspection system comprising ground control station, and multirotor UAV; which the ground control station contains: a ground control system, an image receiving system which includes high definition image and thermal image, data processing and display system; The multirotor UAV system includes: UAV frame, Electrosmog meter, High Definition optical zoom camera, hand held eddy current inspector probe, robotic arm, flight control system, power system, transceiver system, electrical actuators, acoustic stealth propellers and electromagnetic isolators
2. The system according to claim 1, the MUAV system will lift from the ground and attain a certain altitude and hold a position at certain distance from the telecom tower. The Electrosmog meter and high definition optical zoom camera is mounted on the MUAV frame
3. The system according to claim 1, the MUAV system will be equipped with Ultrasonic testing equipment, X-Ray meters, Eddy current inspectors, pulsed eddy current inspectors and other relevant corrosion and erosion measurement meters
4. The system according to claim 1 and 2, the Electrosmog meter will give the radiation level values in a directional and non-directional measurement and visual footage of the structural inspection will be send to the ground control station as a video signal to the ground control station
5. The system according to claim 3, will send all the data to ground station where it is analyzed and then it is send to all the concern authorities and online public database for reference
6. The system according to claim 4, on line monitoring of radiation pattern with a sophisticated software, the strength and threat of radiation level is determined.



6. DATE AND SIGNATURE

Name	Signature with date
VELTECH Dr RR & Dr SR TECHNICAL UNIVERSITY	 7/10/14

8 OCT 2014

Applicant : VELTECH Dr RR & Dr SR TECHNICAL UNIVERSITY

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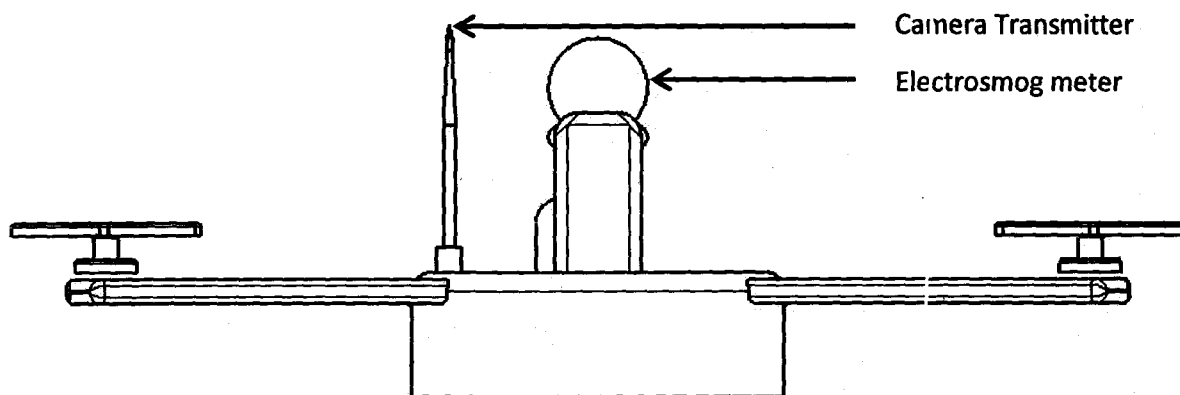


Fig.1 Front view of multi rotor system

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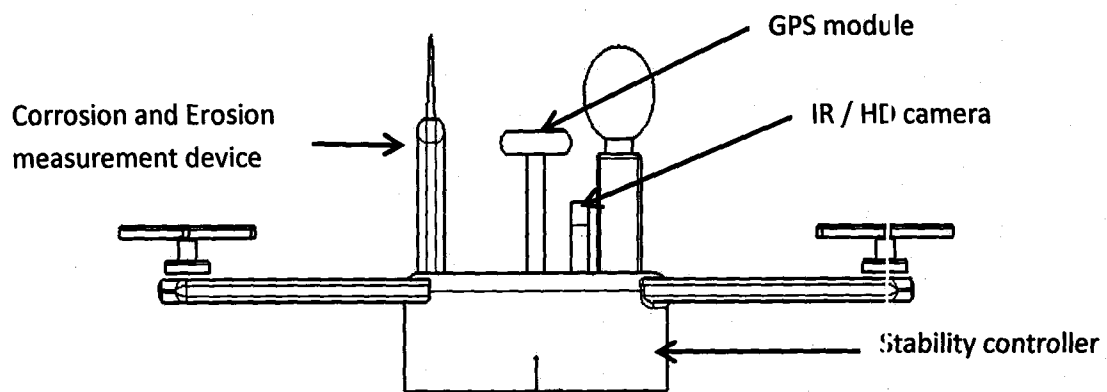


Fig. 2 Side view of multi rotor system

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Applicant : VELTECH Dr RR & Dr SR TECHNICAL UNIVERSITY

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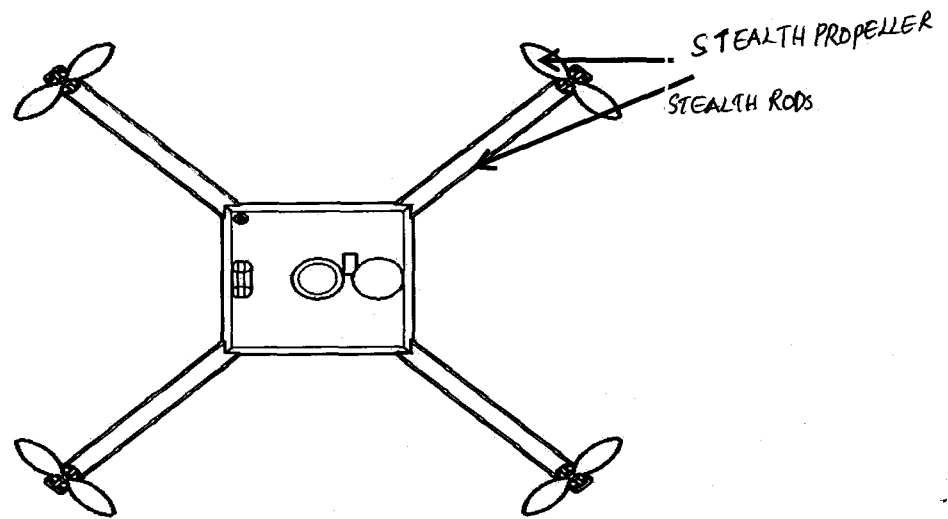


Fig. 3 Top view of multi rotor system

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DESCRIPTION**FIELD OF THE INVENTION**

The Present invention is related to Telecom Tower Inspection Using a Multi Rotor Unmanned Aerial Vehicle (MUAV) System equipped with Electro Smog Meter to measure the radiation levels, electric field strength, magnetic field strength, radiation power density, and radiation pattern, High Definition and Infrared Cameras for visual inspection of tower structures, tower members, tower connections, antennas, antenna mountings, poles, waveguide bridges, corrosion and erosion of structural components, breaking of guy wires, missing of bolt and nuts, verticality of the structure, lighting and earthing system, Portable Eddy Current Inspector for corrosion detection and flight stability controller to control the vehicle.

BACKGROUND OF INVENTION

Telecom Tower inspection and maintenance is very difficult because humans have to climb up on the high altitude tower structures and perform inspection. Telecom Tower inspection is performed for checking the cable breakage; find damage of insulators, hot spots, antenna orientation, missing of nuts and bolts, structural damage and radiation levels. Manually inspecting the tower is tedious because one has to rise up the tower with heavy equipment. This mode of working will have many disadvantages such as huge risk to life, long inspection cycle, high working intensity, and infrequent inspections on towers. Inspection through helicopters is efficient mode performing it compare to manual operation but it is more expensive. So to overcome all these problems a Multi Rotor Unmanned Aerial Vehicle (MUAV) system is developed.

PRIOR ART

Earlier the telecom tower inspection is done only by humans manually (i.e.) by climbing on a high altitude tower with heavy equipment with or without tower electricity shut down. Some of the drawbacks of such inspection are (1) it is highly risky for a man to work on such high altitudes without proper protection (2) There is no guarantee for the worker's life (3) The entire tower is sometimes needed to shut down for towers electrical inspection (4) There is a chance of long term radiation exposure to the workers.

With respect to Chopper Inspection System, Helicopter is used for inspecting the telecom towers where the human will do the necessary repair and maintenance. Some of the drawbacks are (1) Using the helicopters for inspection is good idea in reducing the worker's risk but it's very costlier (2) Maintaining a clearance with the tower structure for inspection is difficult (3) It is also risky for the worker since he has to come out of the chopper for repairing.

The current invention can overcome all those drawbacks of existing. Here the Telecom Tower inspection and maintenance is automated through the multi-rotor UAV system. The developed system can send the online video signal to the ground station in real time. It can be controlled from the ground with the help of Radio Control station. It gives the radiation levels at different altitudes and at desired distances. The life risk of the worker is reduced. The structure of the system is simple. It is less weight and easy to operate. The obstacles can be avoided easily without incorporating complicated mechanism. Inspection can be done very cheap and easier way compared with using helicopters.

SUMMARY OF THE INVENTION

The Telecom Tower Inspection MUAV can reach different altitude levels, avoid obstacles and transmit close and clear view of tower antennas, structural damage, missing nuts and bolts etc. The developed UAV is also equipped with Electro Smog Meter which gives out electric field strength, magnetic field strength, radiation power density, and radiation pattern at different attitudes and altitudes. The onboard autopilot in the system will control the attitude of the vehicle and also controls the lateral and longitudinal motion. The MUAV system is equipped with DJI A2 flight stability system which enables the system to resist gusty winds, sudden low voltage protection and motor fail protection. In addition, the onboard cameras will provide the live High Definition (HD) video and IR information of the structural damages and verticality of tower to the ground control station. The online video signals are used to check the cable breakage, damage, hot spots and other relevant faults in the tower. The system is completely shielded with the help of Aluminum foil and also carbon impregnated poly urethane material to avoid the electromagnetic interference.

The important parts of the novel invention are (1) UAV with Electromagnetic shielding (2) Electrosmog Meter for radiation level measurement. (3) Controller for flight stability with GPS (4) On Board HD and IR cameras for visual inspection of towers (5) Corrosion and erosion measurement devices.

Brief description of the Drawings

The figure above illustrates various views of the Unmanned Aerial Vehicles.

Fig 1 is the front view of multi- rotor system.

Fig 2 is the side view of multi- rotor system.

Fig 3 is the top view of multi- rotor system.

Detailed Description of the figures

Fig. 1 shows front view of Multirotor system equipped with Electrosmog meter and a video signal transmitter are indicated. Fig. 2 shows the corrosion and erosion measurement device, GPS module, High Definition (HD) and Infrared (IR) cameras and On-board controller with Inertial Measurement Unit (IMU). The Fig. 3 indicates about the stealth propellers and stealth structural members to safe guard vehicle from the enemies.

Detailed description

The objective of the present invention is to inspect the damages of telecom tower structure, antennas, antenna mountings and other accessories, measuring the radiation level at certain altitude and also corrosion and erosion of structural members of telecom tower. The MUAV system shown in Fig. 1 with Electromog meter is used to measure the electric field strength, magnetic field strength, radiation power density, and radiation pattern at different attitudes and altitudes and the camera transmitter will send the video signal to the ground control station. The corrosion and erosion measurement devices are used to predict the level of damage of structural members of tower through image processing technique, GPS module provides the path planning to the MUAV system and also send the information of altitude and attitude of MUAV in the flight hovering mode. The HD and IR cameras are used to obtain the visual information of telecom tower structure damage, antenna mountings, missing of bolts and nuts and other visual inspections and transmit the same to various parts of telecom government agencies in real time. The on-board microcontroller with IMU used to stabilize the MUAV system in the desired altitude and attitude to achieve hovering of the vehicle. In order to safe guard the vehicle from enemies target, the MUAV system structure is coated with acoustic, visual, infrared, RADAR stealth materials and stealth propellers are used.