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# Mosquito Killing Drone

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**ABSTRACT:** Multirotor unmanned aerial vehicles are a popular up and coming platform for autonomous robotics research. This report outlines the design and implementation of a multithreaded software system and quad copter with a 3DOF robotic arm carrying payload or weapons controlled by a DJI NAZA .

An array of sensors including a GPS, an IMU, a laser and a camera are used on the quad copter, and the software system is responsible for collecting data from and monitoring these sensors through their lower level libraries. A modular approach is taken to design a foldable quad copter for military so that the system can be used in a variety of applications.

The applications tested in this project were: GPS waypoint navigation and single coloured object tracking. GPS navigation was achieved with a maximum path deviation of 5.66m. A discussion on improvements to the navigation algorithm and the incorporation of course correction methods is provided. Object tracking algorithms were implemented using center of mass and camshift techniques. Now days the multirotor are used in variety of areas so we are making flexible for military purpose.

**Keywords:-**Quad Copter, Multirotor, Drone, Condition Monitoring, Mosquito.

## I. INTRODUCTION

Multirotor UAV (unmanned aerial vehicles), namely quadcopters and quadcopters s, have become increasingly popular in recent years. Like the similar single rotor helicopters, they possess the ability to hover on the spot but have the added advantage that they are far more maneuverable; they can move in directions left and right just as well as forwards and backwards. The multirotor technology is becoming more popular and viable for industrial applications as the battery technology used to power the copters becomes lighter, lasts longer and becomes more cost effective. The large hobbyist following has also made the technology widely accessible to researchers.

UAVs are currently being used in several industrial applications. In the mining industry they are used for aerial mapping, surveying and mining exploration . In the oil and gas industry they are used in both onshore and offshore settings for flare stack, pipeline and structural inspections . Similarly, they are also used in the power industry for transmission line inspection . Each of these applications takes advantage of the large areas of operation and the ability to remove workers from hazardous environments.

However, multirotor technology has only recently become viable for industrial uses and there is still much room for research into the many possible applications for this technology.

**Motivation**

Difficult terrain and threats, such as ambushes and Improvised Explosive Devices (IEDs) can make ground-based reconnaisance and surveillance a dangerous challenge. While helicopters can easily bypass those problems, they often present logistical challenges of their own and can subject flight crews to different types of threats. Additionally, they are expensive to operate and the supply of available helicopters cannot always meet the demand for their diverse operational services. UAV accidents do not risk the lives of pilots, as do the manned aircraft systems.

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**Goals / design problem**

The problem addressed by this part of project is lack of precise cutting tools for designing our own frame for the UAV project for the give material

## II. LITERATUREREVIEW

Many research have been made on quadrotor by worldwide researchers. Pounds et al. presented fundamental dynamics analysis and control approaches through the design of a large-size quadrotor with total weight of 4kg and capable of lifting a 1kg payload which was deemed necessary for the computers and sensors of the time [4], [5]. Bouabdallah and Siegwart accomplished impressive results in control and state estimation with a quadcopter platform and a ground station. Image data was sent to the ground station, processed, and commands were transmitted back to the flying vehicle over a radio communications link [6]. Javier, Masoud and Bruce presented the usability of quadcopter as safety inspection tool in industries. They focused on the construction industry. Their study proposed the use of a quadcopter to fly over the construction jobsite and provide the safety manager with real time information about what is happening on the jobsite. Also through the communication tools embedded in the quadcopter, safety manager can interact directly with workers [7]. Tsubasa, Andrew, Ehrich, Eric, Paul and John proposed the concept of non-destructive evaluation of structures like bridges, where using equipment mounted on a highly stable and mobile UAV like quadcopter is more efficient and economical. The stability issue is addressed immediately by the quadcopter concept; however there was a need of a structure that was stiff, lightweight and less complex [8]. Recent case of using quadcopter for civilian application is when tsunami stuck the Fukushima nuclear power plant in Japan on the 11 th March, 2011.Dut to very unsafe conditions at the plant, Tokyo Electric Power (TEPCO) used a US-made micro aerial vehicle to photography the nuclear plant from above. The flying robot had already had already been used by the US military to find roadside bombs in Iraq [9]. The practical use of a quad copter was cited in New Zealand to examine the front of the Roman Catholic Cathedral in Christ church that was damaged in the 22 February, 2011 earthquake [10]. Universities and research institutions have started using this quadcopter as an experimental platform in different researches such as autonomous surveillance and navigation [11], human-machine interaction [12], and even as a sport assistant by providing athletes with external imagery of their actions [13].

## III. THEORY

Multirotor UAVs are a keen platform for many autonomous aerial robotics research projects. Of the literature surveyed, research divides into either indoor applications, mainly employing a vision based navigation system, or outdoor applications using GPS based navigation. Common across the literature are the 5 parts of an autonomous aerial robotic system:

- Sensors and hardware
- System modeling
- Control loops

**Sensors and hardware**

Nearly all of the projects surveyed used an IMU (inertial measurement unit) [917], a device that contains accelerometers, gyroscopes, magnetometers and an embedded controller to combine readings to provide information on the UAV's roll, pitch and yaw, as well as accelerations in each direction. The acceleration data can be integrated to provide positional data, but as discussed in many papers [10, 15, 17], the accumulation of errors makes readings unreliable without supplementation with other sensors.

**Modeling**

Most copter project have involves kinematic modeling the copter system. The extent of modeling varies across the literature. The most basic models are based on the equations of Newtonian motion . For a hovering copter, the force of upward thrust is equal to its weight. The copter moves by adjusting roll and pitch, such that a component of thrust is in the horizontal plane. Other projects use much more advanced models, incorporating fluid dynamics, blade flap effects and gyroscopic effects .

A novel approach to modeling was taken by , in which the tuning process was automated. The copter was set up in an environment with VICOM infrared tracking cameras, so that the copter's pose was digitally known at all times. Starting from the first principles model, the copter was instructed to do a flip. The controlling computer then readjusted the model parameters to match the observed path and the process reiterated until an accurate model was determined.

**Control loops**

Traditional PID controllers have been used for both copter stability and for velocity regulation Modern control techniques including state variable feedback and linear quadratic regulator systems have also be used and found

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satisfactory.

## IV. COMPONENTS

**Microcontroller:** Microcontroller consists of 3-axis gyroscope and 3-axis accelerometer. An accelerometer is a device measures acceleration forces. A gyroscope is a device used primarily for navigation and measurement of angular velocity [15]. 3 axis gyroscope are often implemented with 3-axis accelerometer to provide a full 6 degree of freedom [DOF] motion tracking system International Journal of Engineering Development and Research (DC). **Brushless Motor:** Brushless motors has more advantage compare to brushed motor, force motor and servo motor in terms of comparatively more efficiency, reliability, longer life span, more power, high torque per weight, reduced noise factor, elimination of ionizing sparks from commutator and overall reduction of electromagnetic interface.

**Propellers:** Propellers are used to generate aerodynamic lift force. A pair of clockwise rotating and a pair of counter clock wise rotating propellers nullifies the gyroscopic effect of each individual motor. We will be using propellers having diameter of 11 inches and pitch of 4.7 inches/revolution.

**Electronic Speed Controller (ESC):** An ESC is an electronic circuit used to vary an electric motor's speed and also acts as dynamic brakes of the system. An ESC controls the brushless motor by converting the supplied DC from the battery into three phased AC. We are using v3.1, 25 A basic Turnigy brushless speed controller.

**Battery (LiPo):** Lithium polymer batteries (LiPo) are most popular for powering remote control aircraft due to its light weight, energy density, longer run times and ability to be recharged. We selected zippy 5000mah, 11.1 V, 3 cell, 25 C battery.

**Lippo Alarm:** A Lippo alarm is an audible and visual alarm that plugs into battery to provide a voltage warning during flight to land the quadrotor prior to failure due to low voltage.

**Remote controller (RC):** A radio control (RC) system needs a transmitter and receiver. Remote controller is used to serve multi purposes like voltage regulation to ES.

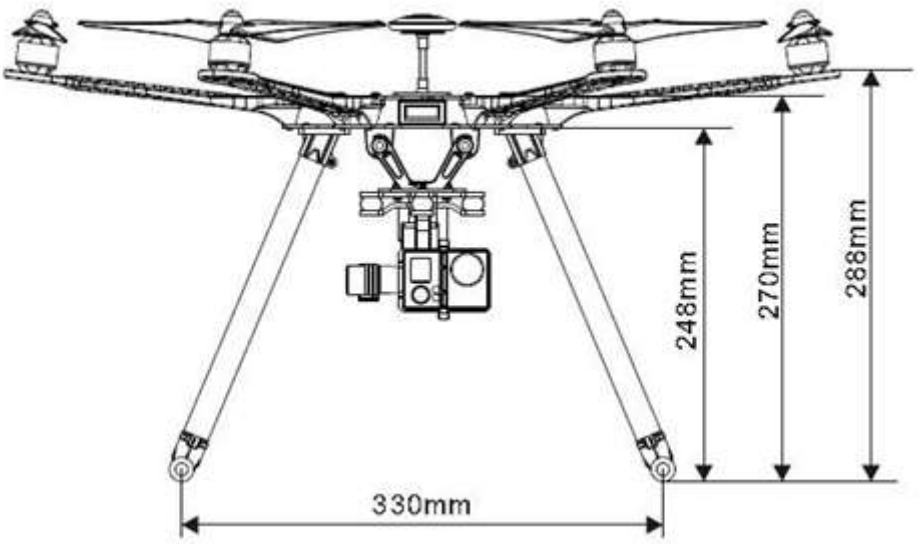


**Fig.Landing Gear Design**

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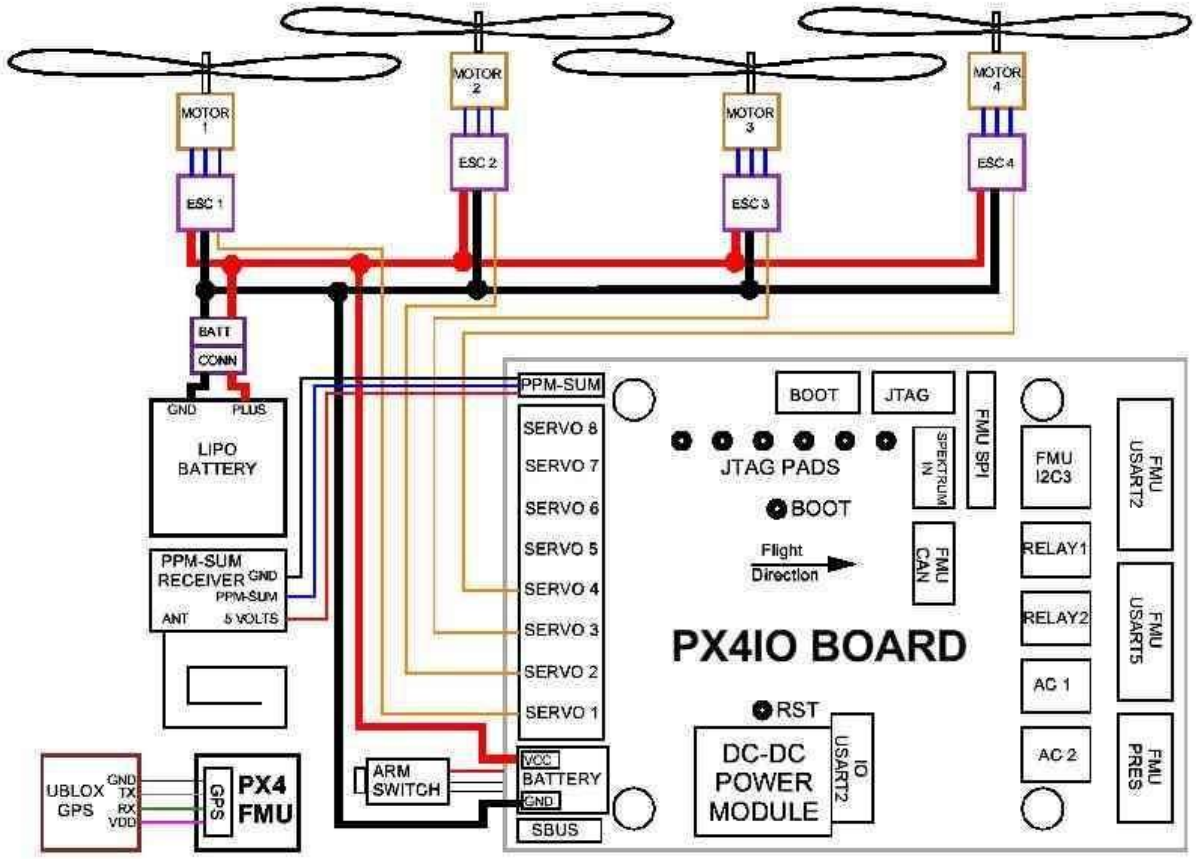


**Fig: wiring layout**

**Actual application area:**

While the initial goal of creating mosquito killing drone hexacopter. We used information for hexacopter frame selection and control. We find the information for making smoke for killing mosquito. We learned important soldering and balancing. Motor frame, design and electrical system fabrication skill including making a power harness and digital to analog motor control.Arduino programmer is a difficult and more complex we learned.

## V. ADVANTAGES AND DISADVANTAGES

**Advantages**:

1) The drone has don't require mechanical linkages to vary the rotor speed.

2) It sprays the liquid in narrow space area.

3) It spray mosquito killing liquid in drainage pipes, this is helpful for human safety.

**Disadvantages:**

1) It is very costly equipment.

2) The ambition is followed by complexity in calculation & designing.

## VI. CONCLUSIONS AND FUTURE WORK

**Conclusions**

A military purpose quadcopters system was designed for and implemented on an autonomous quadcopters . The modular design made this system flexible and adaptable.The use of mutexs to protect resources across threads makes the design robust.

The system was proved to successfully control a quadcopters in autonomous flight. GPS waypoint navigation was achieved with a path deviation comparable to Camera image processing streamlined, effectively doubling previous frame rates. Finally the object tracking was sustained for 1.13 minutes, the entire length of the test.

This system is currently in use with a variety of simultaneous projects, including field searching and multiple object tracking, all tied in together with a web based user interface.

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**Future works plans:**

We plan to build a hydrogen powered UAV instead of using normal Lithium polymer battery technology ,as hydrogen is emissionless and it can also provide a great increased in flight time

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