RAKSHAK-Police Patrolling Drone With Air Pollution Indicator

[1]Aruna R ,[2]Abhilasha M, [3]Chandini S, [4]Archana KS , [5]Dheeksha S

[1]Professor, ECE Department, SriSairam College of Engineering.

[2, 3, 4, 5]UG Students, ECE Department, Sri Sairam College of Engineering

ABSTRACT

The aim project is to build and program a quadcopter that can be used to collect and detect information of a city. A secondary goal of this project is to use this platform, which can be used by police to threaten the criminals who will be hidden at some narrow places where the police vehicle cannot go**.** Here we are going to implement a drone which can be used by police to threaten the criminals who will be hidden at some narrow places where the police vehicle cannot go. By a loud siren and flash lights using this drone their task will be easy. However, multi rotor 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. **Air pollution sensors** are devices that detect and monitor the presence of air pollution in the surrounding area. They can be used for both indoor and outdoor environments. These sensors can be built at home, or bought from certain manufactures.

INTRODUCTION

Unmanned Aerial Vehicles (UAVs) are crafts capable of flight without an onboard pilot. They can be controlled remotely by an operator or can be controlled autonomously via pre-programmed flight paths. Quadcopter is a device with a intense mixture of Electronics, Mechanical and mainly on the principle of Aviation. they can move in directions left and right just as well as forwards and backwards. The multi rotor 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. Although there are various types of air pollution sensors, and some are specialized in certain aspects, the majority focuses on five components: **ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrous oxide**. The sensors were very expensive in the past, but with technological advancements these sensors are becoming more affordable and more widespread throughout the population. These sensors can help serve many purposes and help bring attention to environmental issues beyond the scope of the human health.

Expected Outcomes of the proposed work:

As per the design specifications, the quad copter self stabilizes using the array of sensors integrated on it. It attains an appropriate lift and provides surveillance of the terrain through the camera mounted on it. It acts appropriately to the user specified commands given via a remote controller .Its purpose is to provide real time audio/video transmission from areas which inaccessible by humans. Thus, its functionality is monitored under human supervision, henceforth being beneficial towards military applications. It is easy to manoeuvre,thereby providing flexibility in its movement. It can be used to provide surveillance at night through the usage of infrared cameras.

TECHNICAL DETAILS AND METHODOLOGY

Principle of Operation:

Frame principle: Frame is the structure that holds all the components together. The Frame Should be rigid, and be able to minimize the vibrations coming from the motors. Quadcopter Frame consists of two to three parts which don't necessarily have to be of the same material:

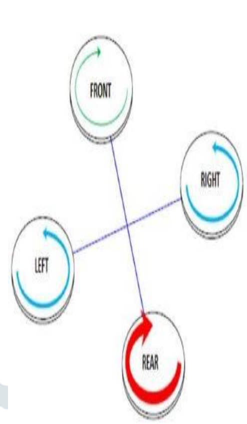
- The centre plate where the electronics are mounted
- Four arms mounted to the centre plate
- Four motor brackets connecting the motors to the end of the arms

Most available materials for the frame are:

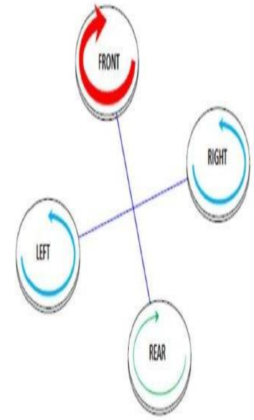
- Carbon Fiber

•Aluminium
• Wood, such as Plywood or MDF (Medium-density fibreboard)
Carbon fibre is most rigid and vibration absorbent out of the three materials but also the most expensive.

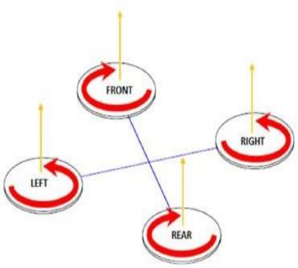
Hollow aluminum square rails are the most popular for the Quadcopters' arms due to its relatively light weight, rigidness and affordability. However aluminium could suffer from motor vibrations, as the damping effect is not as good as carbon fiber. In cases of severe vibration problem, it could mess up sensor readings.
Wood board such as MDF plates could be cut out for the arms as they are better at absorbing the vibrations than aluminium. Unfortunately the wood is not a very rigid material and can break easily in Quadcopter crashes.
As for arm length, the term "motor-to-motor distance" is sometimes used, meaning the distance between the centers of one motor to that of another
motor of the same arm in the Quadcopter terminology. The motor to motor distance usually depends on the diameter of the propellers. To make you have enough space between the propellers and they don't get caught by each other.



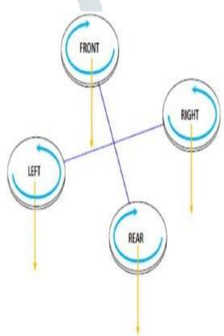
FRONTWARD



BACKWARD



UPWARD



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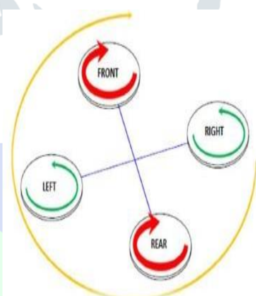
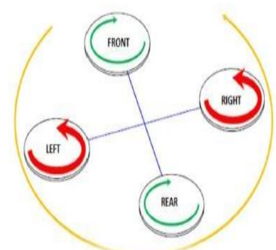


RIGHT MOTION



LEFT MOTION

Controls:

Roll – Done by pushing the right stick to the left or right. Literally rolls the quadcopter, which manoeuvres the quadcopter left or right.

Pitch – Done by pushing the right stick forwards or backwards. Tilts the quadcopter, which manoeuvres the quadcopter forward or backward.

Yaw – Done by pushing the left stick to the left or to the right. Rotates the quadcopter left or right. Points the front of the copter different directions and helps with changing directions.

Throttle – Engaged by pushing the left stick forwards. Disengaged by pulling the leftstick backwards. This adjusts the altitude, or height, of the quadcopter.

Trim – Buttons on the remote control that help you adjust roll, pitch, yaw, and throttle if they are off balance.

The Rudder – You might hear this term thrown around, but it's the same as the left stick. However, it relates directly to controlling yaw (as opposed to the throttle).

Aileron – Same as the right stick. However, it relates directly to controlling roll (left and right movement).

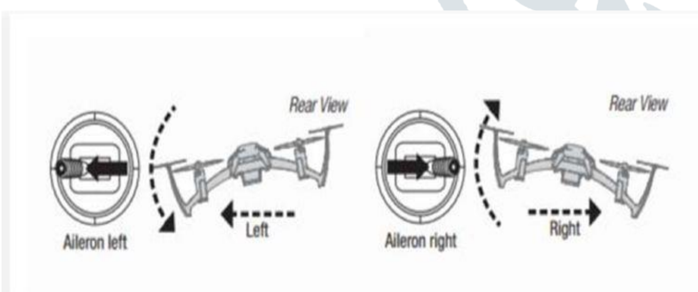
The Elevator – Same as the right stick. However, it relates directly to controlling pitch (forwards and backwards movement).

Manoeuvring-

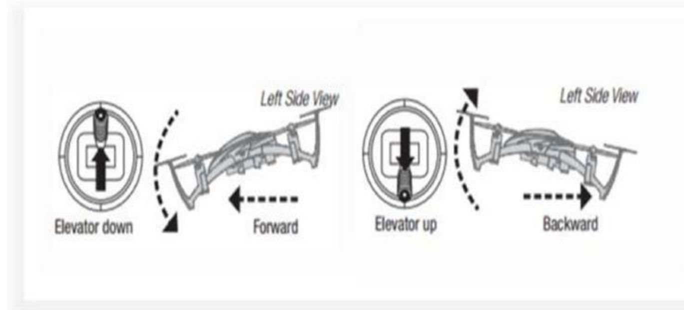
Bank turn – A consistent circular turn in either the clockwise or counterclockwise direction.

Hovering – Staying in the same position while airborne. Done by controlling the throttle.

Roll- Roll moves your quadcopter left or right. It's done by pushing the right stick on your transmitter to the left or to the right. It's called "roll" because it literally rolls the quadcopter.

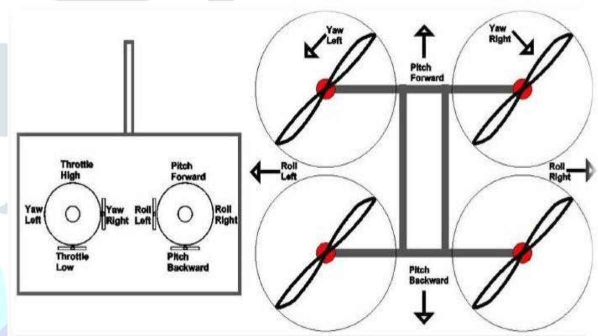


Pitch - Pitch is done by pushing the right stick on your transmitter forwards or backwards. This will tilt the quadcopter, resulting in forwards or backwards movement.



Yaw- This is done by pushing the left stick to left or to the right.

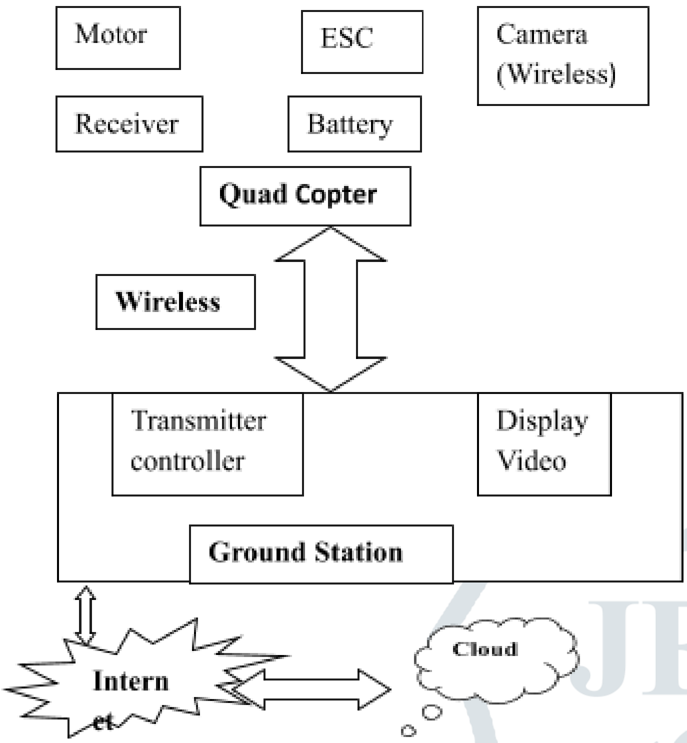
Throttle- Throttle gives the propellers on your quadcopter enough power to get airborne. When flying, you will have the throttle engaged constantly. To engage the throttle, push the left stick forwards. To disengage, pull it backwards.



MATERIALS USED FOR DRONE:

1. Quadcopter HJ450 Frame
2. ESC-30A
3. Brushless motor-1000kv
4. Propeller
5. Flight controller KK 2.1.5
6. Fly sky transmitter and Receiver-CT6B
7. Battery
8. Camera

BLOCK DIAGRAM



HOW DOES IT WORK??

Quadcopter send the video feed to the ground station. User can control the drone using the video feed. And can monitor and anything then as per the user request it can take the still photo and data can be send to server for future backup.

Quadcopter Essentials (Component requirement and functionality)

Every radio controlled (RC) quadcopter requires, at minimum, the following components: a frame, motors with propellers, motor speed controllers, a battery, a radio receiver, a flight controller, and an attitude sensor. This section will discuss the function of each component, why it is necessary, and what considerations to make when selecting that component.

1. Quadcopter Frame

The frame of the quadcopter provides the physical structure for the entire aircraft. It joins the motors to the rest of the aircraft and houses all of the other components. The frame must be large enough to allow all four propellers to spin without collision, but must not be too large and therefore too heavy for the motors. For our quadcopter we chose a Hobbyking SK450 frame as seen in Figure 1, which measures at 450mm across opposite motors.

Quadcopter

2. Motors and Propellers

The motors spin the propellers to provide the quadcopter with lifting thrust. Quadcopters almost exclusively use brushless DC motors, as they provide thrust-to-weight ratios superior to brushed DC motors. However, they require more complex speed controllers.

Hobby motors are typically given two ratings: Kv ratings and current ratings. The Kv rating indicates how fast the motor will spin (RPM) for 1V of applied voltage. The current rating indicates the max current that the motor may safely draw. For our project, we selected 1000Kv, 15A max NTM motors from Hobbyking .

Motor **Propellers**

3. Speed Controllers

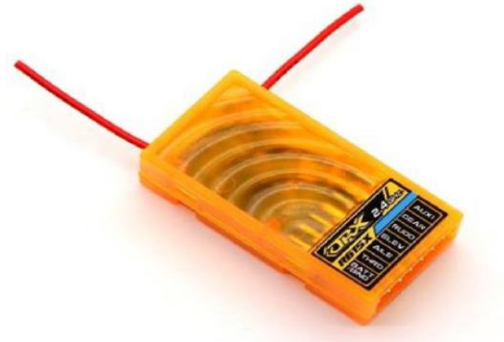
Every motor needs an individual electronic speed controller (ESC for short). These speed controllers accept commands in the form of PWM signals and output the appropriate motor speed accordingly. Every ESC has a current rating, which indicated the maximum current that it may provide the motor without overheating.

4. Battery

The battery provides electrical power to the motors and all electronic components of the aircraft. Lithium Polymer (LiPo) batteries are used almost exclusively, because they have high specific energy. Hobby LiPo batteries have a capacity rating and discharge rating. The capacity rating, in milliamp-hours (mAh) indicates how much current the battery may output for one hour. Discharge rating, indicated by the letter "C", show how fast the battery may be safely discharged.

5. Radio Receiver

The radio receiver (Rx) receives radio signals from an RC transmitter and converts them into control signals for each control channel (throttle, yaw, roll & pitch). Modern RC receivers operate on a 2.4 GHz radio frequency, while older Rx units often used 72 MHz frequencies. Rx units may have as few as 4 channels, but many have more channels for additional control options. We selected a Hobbyking OrangeRx 6 Channel Receiver for this project.

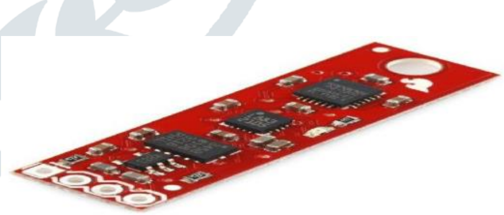


6. Flight Controller

The flight controller is the "brain" of the quadcopter, and performs the necessary operations to keep the quadcopter stable and controllable. It accepts user control commands from the Rx, combines them with readings from the attitude sensor(s), and calculates the necessary motor output.

7. Attitude Sensor

The attitude sensor provides the flight controller with readings of the quadcopter's orientation in space. At minimum this requires a gyroscope, but most quadcopters also incorporate an accelerometer. For a self-stabilizing quadcopter (such as ours), an accelerometer is required. We selected a **Sparkfun 9DOF Sensor Stick**. This board includes an ADXL345 accelerometer, an ITG-3200 gyroscope, and an HMC3885L magnetometer.



Implementation

While the concepts of how a quadcopter operates are simple, implementing each subsystem requires quite a bit of attention to detail in order for the aircraft to function properly. This section will discuss the details of how each system works and what was necessary to implement it.

Receiver

The RC receiver accepts radio signals from an RC transmitter and translates it into separate channels of control. The receiver in our quadcopter is capable of outputting 6 channels of control, including throttle, yaw, roll, pitch, and 2 auxiliary channels (controlled by toggle switches on the transmitter). RC signals are a form of specialized PWM, in which the length of the HIGH pulse contains the output information, as seen in Figure 11. Each HIGH pulse varies from approximately 1 ms to 2 ms, with a period of 20 ms. In order to read this signal into the Arduino flight controller, the Arduino needs to measure the length in microseconds of the HIGH pulse. The simplest way to do so is to use the pulseIn() function, which measures pulse lengths on a pin. However, this method is not suitable for a flight controller because the function blocks the rest of the program from running while it waits for a pulse.

Interrupts

A much better way to measure RC signals is to make use of interrupts. Interrupts are functions that are triggered by changes on a specified I/O pin on the Arduino, and may interrupt the main program to execute. An example interrupt function to measure an RC signal.

To measure multiple channels of RC input, the Arduino must have an individual interrupt for each channel. Because there are only 2 external interrupts available on the Arduino Pro Mini, we must use a library called *PinChangeInt*.

PROGRAM

```
void interruptFuncChan0()
// Interrupt function to measure RC pulses
{
// if pin is high, new pulse. Record time
if (digitalRead(RX_PIN_CH0) == HIGH)
{
rxStart[0] = micros();
}
// if pin is low, end of pulse. Calculate
pulse length and add channel flag. Also
reset channel start.
else
{
rxValShared[0] = micros() - rxStart[0];
rxStart[0] = 0;
updateFlagsShared |= RX_FLAG_CH0;
}
}
```

APPLICATION AND FUTURE USE

The drone is a technique that turned into methodology. It finds its application in various fields.

- **Defense**

  Drones were first introduced for military purpose. Drones in the military are mostly used for surveillance and offensive operations. Drones like Prox dynamics is quite famous for military around the world.

- **Criminal Identification**

  This drone will help us to find the criminals who are hidden in narrow places where police vehicles cannot go. This drone will give out a loud siren when a criminal is found in a narrow place

- **Pollution Detection**

  This drone is helpful in finding out the amount of pollutants present in the atmosphere.

FUTURE USAGE OF DRONES

The Future Uses of drones are

- **Personal transport**

  In Future drones can also be used as a personal transport where we can reach to a destination of our choice with ease .Tech giants such as uber is also trying its level best to invest greatly in unmanned aerial vehicles.

- **Delivery**

  With regard to personal transport the technology of drones will help to make drone deliveries happen.

CONCLUSION

In this paper we have described about how can a drone be used for Criminal identification, Pollution detection and for the purpose of surveillance. This drone can be used in various fields such as criminal identification, Air pollution monitoring surveillance.

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