

# Quadaerator

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**Abstract:** *This paper focuses on the introduction to Quadaerator which is the latest innovation of quadcopters. The name can be derived from two units, a quadcopter and an aerator. Therefore, a Quadaerator is the combination of these two separate units. The basic function of this device is to provide a cooling effect to an individual when walking in outdoors. It also consists of additional features like a heater and a parasol. In lieu of its usage as a cooler in summers, a heater fan in winters and a parasol in monsoon, it is very clear that it is suitable for all seasons. This plays a significant role in reducing the number of deaths due to weather conditions. Also, this looks forward to expanding the applications of drone technology and, in the near future, drones flying all over the sky.*

## 1. Introduction

Deaths as a result of hot weather are to soar up over the next four decades as a result of climate change. Researchers have predicted that the number of annual deaths occurred as a result of the heat will rise by 257% by 2050. It has also been speculated that without adaptation, the number of heat-related deaths will increase by 66% and cold weather related deaths will increase by 3% in the 2020s. This means that by 2080 there will be around 12,500 heat-related deaths and 36,500 cold-related deaths. It is said that the number of hot weather days is projected to rise steeply, increasing three-fold by 2080. Meanwhile the number of cold days is expected to fall, though at a less dramatic pace. At present, there are around 41,000 winter related deaths and 20,000 summer related deaths.

Contribution of this paper includes the new invention which will help prevent increase in the rate of deaths due to hot and cold weather, consequently saving mankind. This paper attempts to focus on an all in one flying unit used for basic cooling and heating as per the required circumstances. The basic idea is to provide sufficient cooling any person in order to avoid fatalities associated to the heat. This is achieved by a simple UAV hovering few inches above a person. The basic design of the device comprises of a quadcopter programmed to fly over a person and an axial ventilation cooling fan installed in the unit to provide a cooling effect during summers. A heating device equipped in it functions as a heater to provide hot air in winters.

The device is programmed to follow the person. A microprocessor, receiver and transmitter form the basic components involved in the controlling and running of the unit and its motors respectively. It also implements an extended feature. During the rainy weather, when the device senses water droplets, it opens up a shield as a safeguard from the rain. This new innovation will have an immensely positive effect on next generation as deaths caused due to hot and cold weather will be controlled to some extent.

## 2. Laws

According to the Federal Aviation Association (FAA), no approval is needed for recreation. Model aircraft flights

should be kept less than 400 feet above the ground level, should be flown far from populated areas and full scale aircrafts, and are not for business purposes. Therefore, the question is about the commercial use of drones. According to NBC News dated February 2012, the Congress passed a bill requiring FAA to open the sky for drones by Sept. 30, 2015. Since then, FAA has been developing regulations and policies at a slow pace and it is expected that they will be unable to meet the deadline. Most people expect that drones will be common in the future. On March 07, 2014, Fox News reported that a federal judge dismissed the FAA's case against a commercial mini drone used for filming. The reason for the dismissal was "FAA has no regulations governing model aircraft flights or for classifying model aircraft as an unmanned aircraft". The dismissal of this case implies that people can "now" use mini-drones for anything if there is no damage to property until the enactment of new laws on mini drones.

## 3. Features

This will be the very first model with very unique properties unlike other quadcopters, as a result of the inclusion of various other functionalities such as a heater, a Parasol, and an aerator, and its ability to multi-function as a cooling agent during summers, a heater during winters and a parasol for shielding a person from rains. This model not only can fly but can also track location using GPS.

### 3.1 Cooling System

In cooling systems, an axial flow fan is employed to keep the temperature of an individual from exceeding the limits imposed by needs of safety and efficiency. In this device, cooling is provided by an axial ventilation fan that is attached to the rotating element and creates a current of air through the housing. Cooling systems are required almost in every industries including automobiles, industrial plant machinery, nuclear reactors and many other types of machinery and hence it is the latest innovation of implementing a fan in a drone for cooling an individual. The cooling agents customarily employed are air and a liquid (usually water), either alone or in combination. In some cases, direct contact with ambient air (free convection) may be sufficient. In other cases, it may be necessary to employ forced convection created either by a fan or by the natural

motion of the hot body, other than that resulting from variation of density with temperature. Movement of air by a fan is an example of forced convection. The air delivering capacity of axial flow fans ranges from 300 to 14,000 cubic meters per minute. The fan is optimally designed with improved aerodynamics which requires less shaft input power for desired delivery of air volume with total pressure rise as per the system requirement.

### 3.2 Fan heater

A heater that works by passing air over a heat source or a heating element through a fan is used for the purpose of heating effect. This heats up the air, which subsequently leaves the heater, warming up the surroundings. The fan used in the heater is electrically powered. Various heat sources may be used. Electric heating elements are commonly used as heat source in this device. The heater used is usually small as the electric element itself is small, although they may supply several kilowatts of heat.

This device does not require any heat sink as the heat is removed by the fan itself. The fan can be made smaller and efficient without overheating. A part of electricity used to run the fan is partly converted to heat, so that efficiency is not a problem. The heater without external ventilation is nearly 100% efficient, meaning that almost all energy input goes out as heat. However, the overall efficiency decreases if the efficiency of generating the electricity is taken into account.

### 3.3 Umbrella or Parasol

It is a device used to protect a person against rain or sunlight. The word *umbrella* typically refers to a device used for protection from rain. Umbrella canopy are made of fabric or flexible plastic. While the predominant canopy shape of an umbrella is round, canopy shapes have been streamlined to improve aerodynamic response to wind. The umbrella used in this device is a fully collapsible umbrella which completely retracts and fits perfectly into the body of the flying unit, also it is automated with spring loaded controls which is activated by the water sensors. Sensors get activated by the water droplets of rain which then converts the signals into electrical form and send it to the processor. On receiving the signal, the processor commands to open up the lid by motor mechanism through which the umbrella emerges out due to the loaded spring.

## 4. Methods of Control

The standard way to control the Quadcopter in flight is to use a radio control handset. This has been the most common and easy method used for many decades to control the RC devices and it still works very well, there will not be any problems in keeping a connection with the drone. The new advanced and standard method is that higher end drones have the ability to be controlled from a Smartphone or tablet. This is achieved by either a cellular, Wi-Fi or a Bluetooth connection. At this stage it may be ideal for all users because of the Smartphone technology with a strong Bluetooth or Wi-Fi connection keep a stable connection with the UAV. The signal is transmitted by the Bluetooth device

and the receiver on the drone receive the signal which is then processed by the microprocessor device. The microprocessor then establishes the flight control as contained in the codes written by the user. The transmitter device is carried by the user and the Quadcopter follows the signal given by the transmitter device, hence the device follows the path of the user moving in a particular direction

## 5. Equations

- The thrust produced by a propeller

$$T = \frac{\pi}{4} D^2 \rho v \Delta v$$

T = Thrust (N)

D = Propeller diameter (m)

V = Velocity air at the propeller (m/s)

$\Delta v$  = Velocity of air accelerated by

Propeller (m/s)

P = Density of air (1.225 kg/m<sup>3</sup>)

- Power that is absorbed by the propeller from the motor

$$P = \frac{T \Delta v}{2} \rightarrow \Delta v = \frac{2P}{T}$$

$$T = \left[ \frac{\pi}{2} D^2 \rho P^2 \right]^{\frac{1}{3}}$$

- Newton's Law, F=ma, is used to obtain mass.

$$m = \frac{\left[ \frac{\pi}{2} D^2 \rho P^2 \right]^{\frac{1}{3}}}{g}$$

Where g = 9.81 m/s<sup>2</sup>

## 6. Specifications

Frame	: PVC ,30 x 2.3 x 1cm
Processor	: Arduino Uno R3(ATMega328P),5V
Motors	: 1000KV(rpm/v) Brushless motors
Max Power	: 190W
Max Thrust	: 920 grams
Shaft Diameter	: 0.3175cm
Motor Shaft Length	: 4.5cm
Propeller	: 5045P, 12.8x8.9x0.8cm
Battery	: 2200mAh, 3S Li-Po Battery(25C)
ESC(A)	: 30A
Cooler fan	: (12VDC),2500rpm

## 7. Conclusion

Humans in their daily life want things which will make their tasks easier and will provide comfort to them and along with this are economical as well. As we can see from this paper, that the practical implementation of these Quadcopters in daily life can help to save a lot of lives and also become a means of comfort for them. These Quadcopters are small in size and economical and this also leads to the expansion of drone technology and its applications. So wherever required, these flying machines can come into the picture by fulfilling the basic needs and saving human lives in extreme weather conditions. Due to the increase in the number of

deaths caused due to unfavourable climatic conditions, these Quadaerators come in handy.

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