A Technical Research – Multi Axes Ceiling Fan

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Abstract

A ceiling fan is a mechanical device usually electrically powered, Suspended from the ceiling of a room, that uses hub mounted rotating blades to circulate air. The electrically powered ceiling fan was invented by 1882 by Philip Diehl. The disadvantage of existing ceiling fan is to cover small area of room, so cooling capacity will be decrease. A multi axis ceiling fan is a basically modification of existing ceiling fan. A fan mounted overhead for universal adjustment of the air flow direction. Its consists of gear mechanism and ac & dc motor. Multi axes ceiling fan will cover large area of room compare to existing fan. It will rotate about more than one axis.

Keywords- Multi Axes, Gear Attachment, using a Link

I. INTRODUCTION

Ceiling fans are frequently used in tropical areas of the world for low cost indoor comfort. An incremental work in improving energy efficiency of ceiling fans can directly reflect in substantial energy conservation. In this paper, modelling and simulation of the ceiling fan rotating inside the room is performed. Ceiling Fan used for forced air convection to given human comfort. A ceiling fan rotates much more slowly than an electric desk fan; it cools people effectively by introducing slow movement into the otherwise still, hot air of a room.

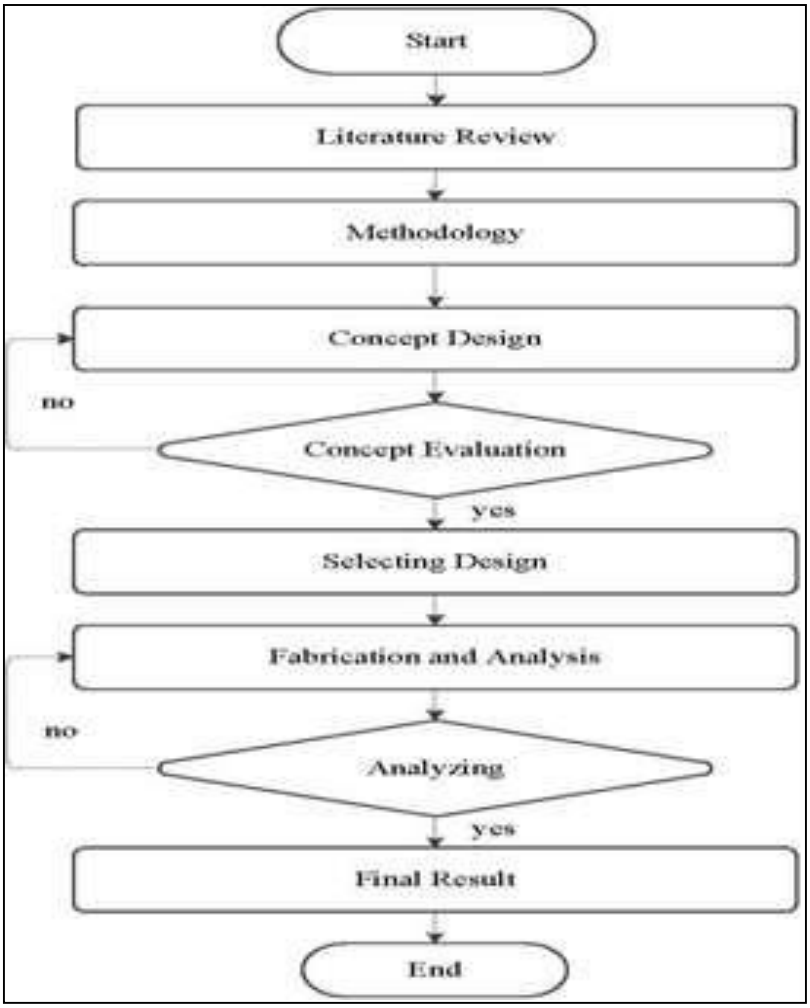
Some ceiling fans are mechanically reversible instead of an electrically-reversible motor. In this case, the blade should be pitched to the right for downdraft, and for updraft. Hunter Hotel Original is one example. In summer, the fan's direction of rotation should be set so that air is blown downward. The blades should lead with the upturned side as they spin. The breeze created by a ceiling fan speeds the evaporation of perspiration on human skin, which makes the body's natural cooling mechanism much more efficient. Since the fan works directly on the body, rather than by changing the temperature of the air, during the summer it is a waste of electricity to leave a ceiling fan on when no one is in a room.

In winter, ceiling fans should be set to turn the opposite and on a low. Air naturally stratifies that is, warmer air rises to the ceiling while cooler airsinks.

Unfortunately, this means it is colder on or near the floor where human beings spend most of their time. A ceiling fan, with its direction of rotation set so that air is drawn upward, pulls up the colder air below, forcing the warmer air nearer the ceiling to move down to take its place, without blowing a stream of air directly at the occupants of the room.

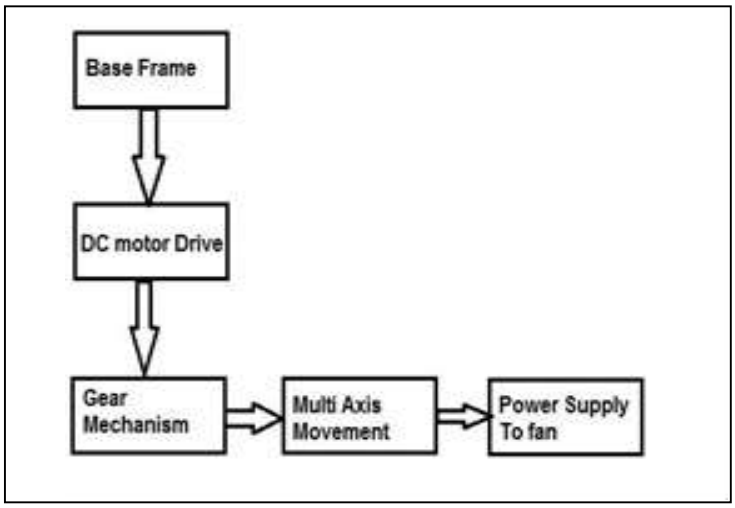
An additional use of ceiling fans is coupling them with an air conditioning unit. Through the wall or through the window air conditioning units typically found in rented properties, usually have both the tasks of cooling the air inside the room and circulating it. Provided the ceiling fan is properly sized for the room in which it is operating, its efficiency of moving air far exceeds that of an air conditioning unit, therefore, for peak efficiency, the air conditioner should be set to a low fan setting and the ceiling fan should be used to circulate the air.

II. FLOW CHART



III. WORKING PRINCIPLE

Fans only move air; they do not directly change its temperature. Therefore, ceiling fans that have a mechanism for reversing the direction in which the blades push air can help in both heating and cooling. Fan unit is connected to the main shaft, and shaft is connected with the elliptical Gear train. We will use gear mechanism to control the direction. Gear train is connected with DC motor, As we give supply to the DC motor, it start rotating the gear train, and so as fan start moving in desired motion.



Base frame is the main part of structure on which mechanism is mounted and ceiling fan is attached with it. We will make structure and ceiling fan from Mild Steel. Base frame have connection of DC motor, on motor shaft we will attach the Gear mechanism. This mechanism having two main spur gear and linkage, this is connected in such a way that, is gives the Multiaxis movement to the fan. Now normal Fan is connected with this mechanism. Since Normal Fan is having steel blade, we will also try same on PVC blade, so rotating force and inertia can be reduced and gives us better stability.

IV. CALCULATION

A. Motor Selection

For our project we are using 0.5 HP Motor.
0.5 HP = 372.5 WATTS RPM of motor = 50
We know that
$P = 2 \times \pi \times N \times T / (60)$ $372.5 = 2 \times \pi \times 50 \times T / (60)$
T = 71.27 N.mtr
T = 71270 N.mm
Speed V = Π x D x N / 60 mm/s
Speed V = 130.83 mm/s Speed V = 0.0130.83 m/s

B. Design of Shaft

Now, we know torque is 5099.9 N Shaft Dia = ds
Now,
Torque Transmitted to the Shaft
$T = \pi/16 \times (ds)^3 \times \tau ms$
$71270 = \pi/16 \times (ds)^3 \times 35 (ds)^3 = 7375.97$
ds = 19.46 mm
We are selecting Diameter of Shaft 20 m

C. Design of Frame

Frame is made up of MS. The welded joint is subjected to pure bending moment. So it should be design for bending stress. We know minimum area of weld or throat area A = 0.707 x s x l
Where s = size of weld l = length of weld
A = 0.707 x 5 x (75 + 40 + 35 + 58 +35) A = 0.707 x 5 x 243
$A = 859 \text{ mm}^2$
Bending strength of parallel fillet weld P = A x f b
$F b = 80 \text{ N} / \text{mm}^2$

As load applied at the end of lever is 250 N. So moment generated at the welded joint is
M =P x L= 250x 450= 112500 N – mm we know $f_b = M / Z$
$Z = \{BH^3 - bh^3\} / 6 H$
$Z = \{40 \times 75^3 - 35 \times 58^3\} / 6 \times 75$
Z = 209824
Calculating induce stress developed in Welded joint
F_b induced = 112500 / 209824
= 0.536 N /mm^2
As induced stress value is less than allowable value, which is 56 N/mm^2 so design is safe.

V. CONCLUSION

A multi axis ceiling fan is a basically modification of existing ceiling fan. A fan mounted overhead for universal adjustment of the air flow direction. It is consists of gear mechanism and ac & dc motor. Multi axes ceiling fan will cover large area of room compare to existing fan. It will rotate about more than one axis. We find design is more complex, so it will take time to make working model. Moreover, fan will also rotate on high-speed, so we decide to make heavy base frame to absorb vibration.

A. Advantages of Our Project

- Very easy and simple to operate.
- It is inexpensive when compare to area of air flow it covered.
- Simple structure, easy to operate.
- Cover more space than conventional fan.

B. Applications

- Office
- Residence
- Forced air circulation during the air conditioning

VI. FUTURE WORK

The present model is semi-automatic and it does not have an automatic control of fan. We can make Automatic and sensor based fan with help of microcontroller. Moreover we can also make it much aesthetic in look by adding LED or other features.

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