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Ceiling Fan Shifting Mechanism

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Abstract

As the name indicates the idea of this paper is that the Fan will be shift from one location to another location as per the user's need. In short we can say that Fan is travelling on ceiling as per the user's expectation. The working principle of the mechanism is to convert rotary motion into linear motion by using rack and pinion. It provides the air at all the locations of the room. There is no need to sitting in room according to fan. The person who is sitting away from the fan & wants the air without moving from there can easily do it. It also replaces the quantity of fans which are not necessary in a room. It provides the air at all the locations of the room. There is no need to sitting in room according to fan. The person who is sitting away from the fan & wants the air without moving from there can easily do it.

Keywords: *Ceiling Fan, Rotary motion, sliding*

INTRODUCTION

A ceiling fan is mounted on the ceiling of a room or space, usually electrically powered, suspended from the ceiling of a room, that uses hub-mounted rotating blades to circulate air Ceiling fans usually rotate slowly than alternative verities of current fan like electrical table fan. They cool person effectively by introducing slow movement into the otherwise still hot air of an area as the name indicates the idea of this research is that the Fan will be shift from one location to another location as per the user's need. In short we can say that Fan is travelling on ceiling as per the user's expectation.

The working principle of the mechanism is to convert rotary motion into linear motion by using rack and pinion.

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As it is an innovative one. As every innovative thing there is a story behind it.

So the story is that:
When weather was too hot and body was not feeling comfort or mind was not feeling satisfaction. I joined the class.

Due to the hot weather I feel warm due to which I got shower in sweat. When I reached in class, firstly I searched the place where I did overcome my sweat and would feel cool. As our class sitting arrangement has changed so there is a problem in it that the seats are placed far away from the fan locations i.e. at fan site there is no sitting arrangement and the location of the sitting plan has no fan above it. So i was not getting any place where i felt relax. That time was the time of need to think of getting rid of this problem.

That time I thought that why don't we innovate something in fan to overcome this problem. So we decided to innovate the fan by introducing the ceiling fan shifting mechanism in it which travels on ceiling according to the human need.

LITERATURE REVIEW

Westman et al. [2014] .presented a work on master degree project at Halmasted University was made in cooperation with Hunter fan. Hunter fan was one of the leading companies of America. Company wanted the team to adapt the technology for Scandinavian market. Team work with design process based on knowledge achieved from literature study.

Adeeb et al. [2016], Presented the work on parametric study and optimization of nonlinear ceiling fan blade by combining the techniques of degree of experiment, response surface method and CFD. For three blade ceiling fan sixteen cases are design for two level full fractional models. Performance variables were volumetric flow rate torque and energy efficiency.

Cijil B.John et al.int. Journal of engineering research and applications, volume 7 issue 3 (part -6) March -2017, PP. 22-25

Cijil B .John et al. presents a paper on custom angle ceiling fan. This paper tells about the regulation of air flow , where we need air flow by changing the angles .The hooks position in rooms are fixed and when a ceiling fan is placed over there then it will not be possible to spread air at needed place so due to this reason custom angle ceiling fan was used . They reduced the wastage of power by controlling the fan blown air where it is not needed.

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D.H. Pachchinavar et al. (IJETER) Volume 6, Issue 4, April (2018) "Design of an Inverter Using Ceiling Fan "

© D.H. Pachchinavar et al. present a paper on Design of an Inverter Using Ceiling Fan.

This paper tells about the method of generating power by a ceiling fan. This generated power may be stored in a battery for deriving other devices.

DESCRIPTION

A ceiling fan is mounted on the ceiling of a room or space, usually electrically powered, suspended from the ceiling of a room that uses hub-mounted rotating blades to circulate air

As the name indicates the idea of this work is that the Fan will be shift from one location to another location as per the user's need. In short we can say that Fan is travelling on ceiling as per the user's expectation.

When the electricity supply is on, the motor starts working. The pinion is attached with the motor which starts moving on the rack. The pinion teeth are meshed with the rack teeth which provide the linear motion to the plate. As the pinion is mounted on the shaft, the shaft also rotates with pinion which transfers the motion to the roller. The roller performs the two functions:-

1. It provides the support to the plate.
2. It also provides the linear motion to the other side of shaft without friction.

The direction of linear motion of the plate is led by the motor direction where the motor runs in clockwise, leads the forward motion & vice versa. The roller which is attached to the motor is also led by it i.e. it moves clockwise when motor runs clockwise and open the wire length when the plate moves in forward direction while if the motor runs on anti-clockwise, it closes the wire by moving same direction of the motor. The speed of the motor is regulated by the regulator attached with the ON/OFF switch. The ceiling fan which is attached with the ankle plate moves with respect to the plate motion.

Ceiling fan:

A ceiling fan is a mechanical fan mounted on the ceiling of a room or space, usually electrically powered, suspended from the ceiling of a room, which uses hub-mounted rotating blades to circulate air. Ceiling fans typically rotate more slowly than other types of circulating fans, such as electric desk fans. They cool people effectively by introducing slow movement into the otherwise still, hot air of a room.

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Fig. 1

Design & Methodology

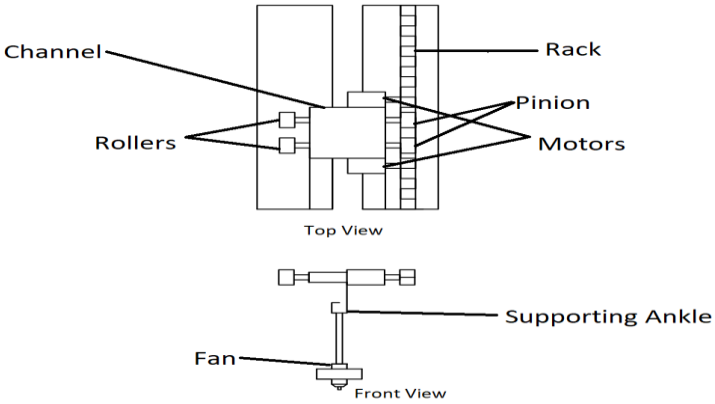


Fig. 2 Layout of mechanism (2-D)

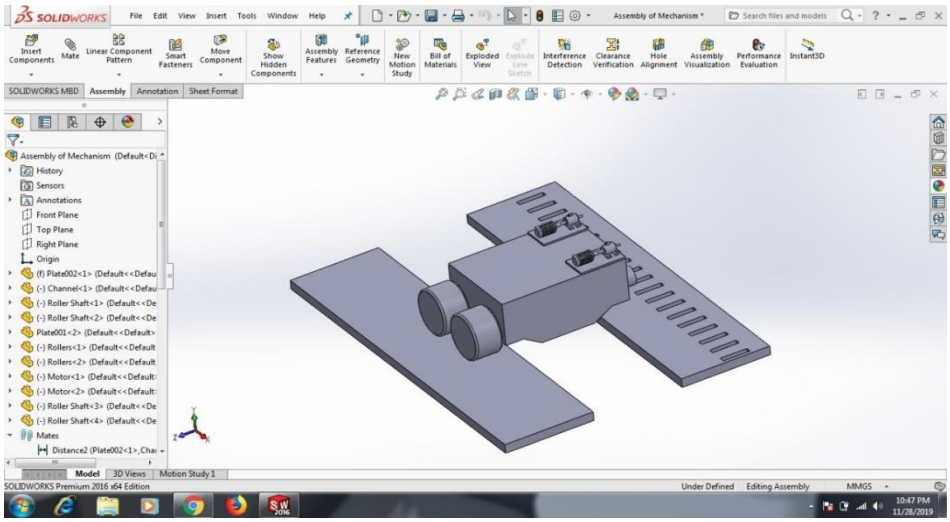
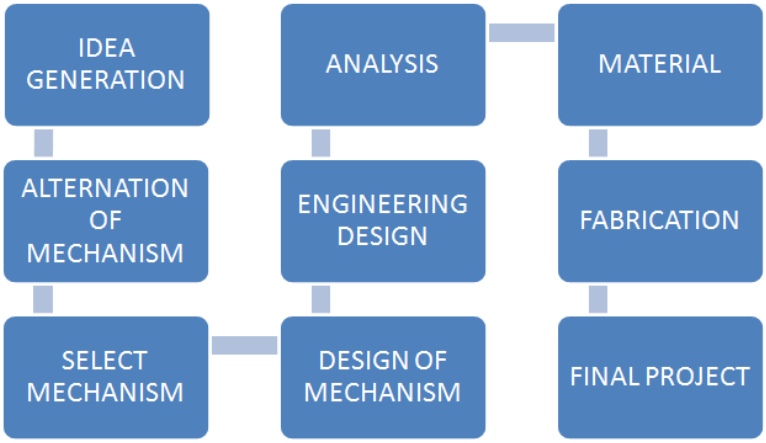


Fig. 3 Layout of mechanism (3-D)

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Block Diagram/ Machine Diagram



Block Diagram of project

Design Calculation

Data:-

1) **Bearing:-** Inner diameter - d
   Outer Diameter - D
   Weight of bearing – W_1

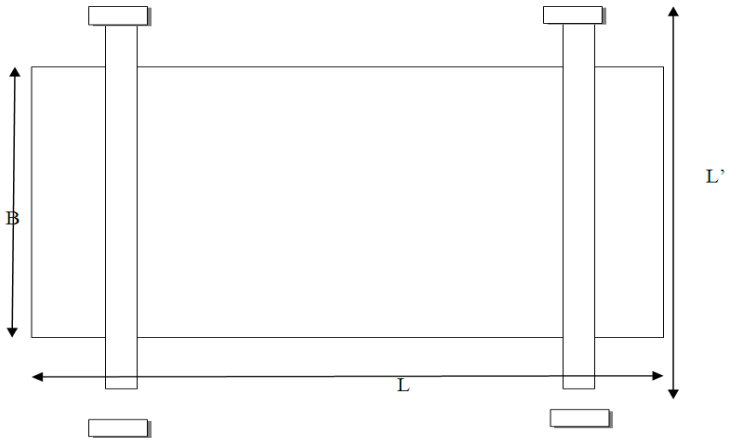
2) **Plate:-** L*B*H
   Where, L = length
   B = width
   H = height

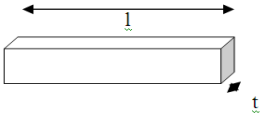
3) **Frame:-** l*b*t
   Where, l = length
   b = width
   t = thickness

4) **Rod:-** Length – L'
   Diameter – D'
   Wt. of rod - W_1'
5) **Motor:-** speed – N

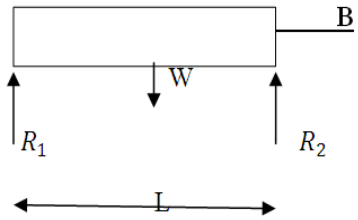
6) **Fan:-** Wt. of fan – W

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Design of plate:



$R_1 + R_2 = W$

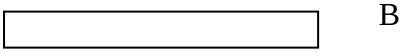
Taking moment about 'B'

⇨ R_1*L = W*L/2

⇨ $R_1 = W/2 = R_2$

Design of Frame:

Let the wt. of fan W & wt. of assembly is W'.
So wt. act one side of frame [(W+W')/2]



Normal reaction 'N' act on each wheel = (W+W')/4

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Friction force on each wheel = [(W+W')/4]*μ

Friction force on 4 wheel = 4*[(W+W')/4] *μ

= (W+W') *μ

Where 'μ' = coefficient of friction

Torque = friction * Radius of pinion

T = (W+W') *μ * R

Power = $2\pi NT/60$ Watt

For thickness of Frame

Let the yield strength of Frame material is ' S_yt' and factor of safety be 'F'

Then, Let the yield strength of Frame material is ' S_{yt}' and factor of safety be 'F'

Then,

Permissible stress (σ_b') = S_{yt}/F.O.S

Let the 'M_b' be the maximum bending moment act on the frame.
Thickness of frame be 't'.

Max. bending stress

$\sigma_b = M_b * \frac{y}{I}$

Where, y = t/2 & I = lt^3/12

σ_b =6 M_b/lt^2

Or

t = $\sqrt{(6M_b/l\sigma_b}$

Final Thickness 0f frame
t' = t + 0.2t

t' = 1.2t

Where, 0.2t = additional thickness for safety purpose.

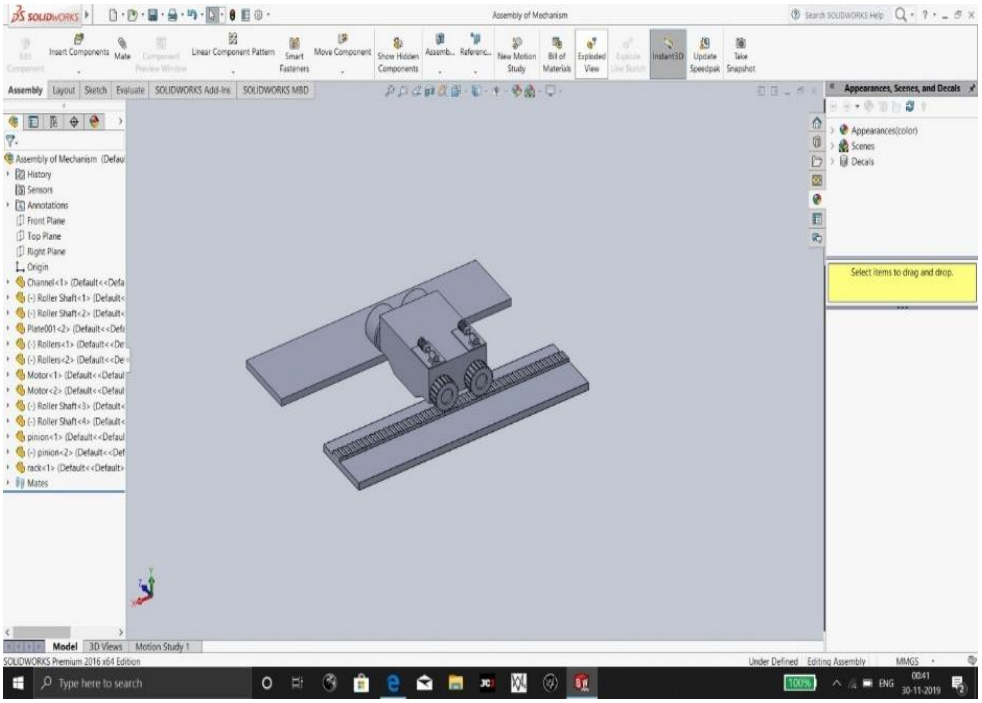
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Working

When the electricity supply is on, the motor starts working. The pinion is attached with the motor which starts moving on the rack. The pinion teeth is meshed with the rack teeth which provides the linear motion to the plate. As the pinion is mounted on the shaft, the shaft also rotates with pinion which transfer the motion to the roller. The roller performs the two function:-

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Circuit Diagram/ Assembled View

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Assembled view

RESULTS

Let the wt. of fan = 4 kg

= 4*9.81

= 39.24 ≈ 40 N

Pinion radius = 12.7 mm

Friction of Force F = 40μ

= 40*0.3

= 12N

Torque = friction force * radius of pinion

= 12*12.7

= 152.4 N-mm

Power required = $\frac{2\pi NT}{60}$

Where, N = 10 rpm

= 159.51 watt

1 H.P = 746 watt

So, power = 0.213 H.P

For Frame

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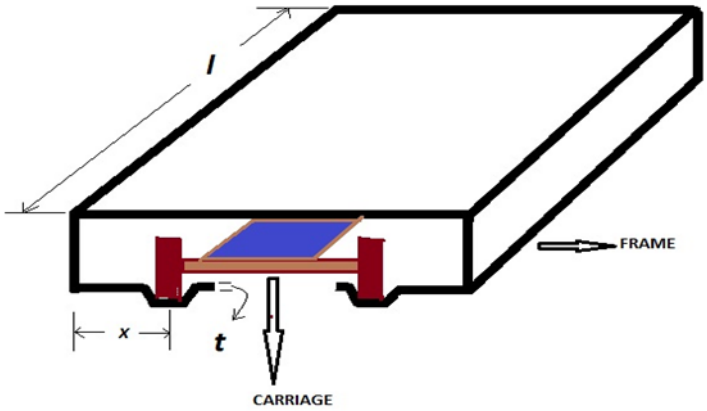


Fig. Block diagram of frame with carriage

x (distance from the end) = 25.4mm

l = 127mm

t = ?

Yield strength of frame = 380 N/mm^2

Factor of safety = 3

Permissible stress σ_b' = 380/3

= 126.6 N/mm^2

Bending stress σ_b = M_b*y/I

Where, y= t/2

I = lt^3/12

= 127*t^3/12

M_b = 20*25.4=508 N-mm

σ_b = 508*6/127t^2

Yield strength of frame = 380 N/mm^2

Factor of safety = 3

Permissible stress σ_b' = 380/3

= 126.6 N/mm^2

Bending stress σ_b = M_b*y/I

Where, y= t/2

I = lt^3/12

= 127*t^3/12

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M_b = 20*25.4=508 N-mm

σ_b = 508*6/127t^2

t = 2

Note: - So, the thickness of frame should be taken = 2 mm. It's because of inertial forces during movement.

Note: - This calculation is based on our assumptions of dimensions & weight.

FUTURE SCOPE

1. It provides the air at all the locations of the room.
2. There is no need to sitting in room according to fan.
3. The person who is sitting away from the fan & wants the air without moving from there can easily do it.
4. It also replaces the quantity of fans which are not necessary in a room.

CONCLUSION

As our project "Ceiling Fan Shifting Mechanism" is an innovative one, we are working on the existing model of ceiling fan to convert it stationary form into movable form by introducing the rack and pinion arrangement in the system. The mechanism of the system in which the system works is ready to work**.**

The designing of the model has been done on the AutoCAD. Also the 3-D model has been made on Solid works which gives the animated idea that how the system works. The software & the design work have been completed. That we can use aluminum alloy material to reduce weight of the frame for better strength at less weight.

Also we enhanced leadership & teamwork by doing the work together.

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