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Study Of Different Winglet Configuration in Ceiling Fan to Improve The Air Flow In Cubic Room

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A B S T R A K

Pemasangan winglet mengurangi hambatan yang ditimbulkan pada pesawat; konsep serupa dicoba pada kipas langit-langit, untuk mengurangi pusaran ujung yang meningkatkan kecepatan kipas dan aliran udara serta mengurangi konsumsi listrik. Berbagai bentuk pemasangan winglet seperti tepi campuran, tepi tajam, bentuk baji, segitiga. Aliran udara diukur secara eksperimental di berbagai lokasi dengan berbagai kecepatan dan hasilnya akhirnya didiskusikan. Ada peningkatan aliran udara yang cukup besar dibandingkan dengan tanpa pemasangan winglet.

A B S T R A C T

Winglet attachment is reducing the induced drag in aircraft; similar concept is tried in ceiling fan, in order to reduce the tip vortices which increase the fan speed and airflow and reduce the electricity consumption. Various shape of winglet attachment such as blend edge, sharp edge, wedge shape, triangle. The air flow was experimentally measured at various locations in various speeds and results were finally discussed. There is a considerable improvement in airflow as compared to without attachment of winglet.

1. Introduction

Many experimental analysis on the winglet attached to the fan is investigated for the reduction of the induced drag at the tip of the fan blade because of vortices. The investigation is related to the aerodynamic shapes that are molded with blade to decrease the drag and this was the concept taken from the aircraft winglet that is used to increase the lift. there are different types of winglet that has different characteristic that will act a roll to minimize the induced drag. There performance of the aircraft may vary but in fan blade the all types cannot be used because the lift created by the winglet it increase the blade to high performance sometime the increasing in lift make the blade to reduce the air velocity.

1.1. Drag Reduction

The drag acting on the blade is lift induced drag it is formed by the wingtip vertices. Because of this drag high pressure is created and the airflow is pulled towards low pressure airflow by this the drag is produced with the lift. For this the solution can be given by keeping the winglet at the tip so that the high pressure airflow will be decrease in flow to the low pressure airflow and increase in lift is produced.

1.2. Vortices

At the trailing edge of the blade a force is acting when it is in motion it is known as induced vortices .The vertices produce high pressure over the blade or wing and make it to reduce the velocity force of the wing. The high pressure force is moving to the low pressure force like a circular motion, the concept of horseshoe vortex. When the vertices is formed their will be a wake region that makes the lift force to reduce. To reduce the intensity of the wake vortices wing devices are use.

1.2.1. Types of vortices

The two types of vertices are rotational and irrotational vertices or free vertices. The two vertices are different in some characteristics that make different in the performance of the working material.

A rotational vertex is that the vertices formed by a rigid body that it travel along the direction of the rotation and also it will rotate itself. This type of vertices will create more effect on the body and make change in the performance of the body. An irrotational vertex is that vertices formed by the rigid body

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that travel along the direction of the rotation but the body will not rotate itself. this is also called has free vertices.

1.3. Aerodynamic forces

The forces acting on the wing that change the performance is the aerodynamic forces, they are lift and drag. The two forces are opposite to each other and proportional to one another as shown in Figure 1. Because of the some shape change of the wing the drag will over liberated than the lift. In those cases some techniques can be used to increase the lift and equal it. For increase in the lift positive angle of attack should be maintained. At the wing pressure may vary it is due to the pressure drag and also the induced drag will be acting on the wing because of vertices.

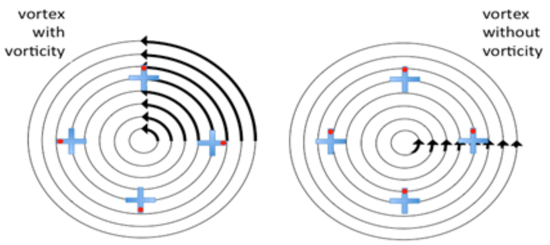

Fig. 1. Types of Vortex

1.4. Boundary layer

Boundary layer separation is at the fan blade is smoothly joining the tip but if the velocity of the blade increase the size of the boundary layer at the tip of the blade that makes the blade to get damaged soon and velocity of airflow to get reduced. Because of the separation the full velocity is not achieved by the blades.

1.5. Types of winglet

The winglet is used to reduce the tip vertices to increase the lift on the aircraft. The types include Blended, wing fence, raked, upswept, drooped, hoerner, spiroid, wing grid. There shapes are joined with span of different wing to reduce the drag. Each type of winglet has different specification to make the different performance high. Carrying high load, increase in lift, stability are some of the performance can be increased by winglet.

1.5.1. Blended winglet

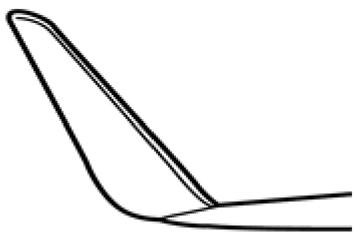

Fig. 2. Blended winglet

The Figure 2 shows blended winglet is a shape of smooth curve fixed at the tip and used to decrease the wingtip vertices. It is helpful in increasing the performance 60% more than that of other conventional winglet because it performance is to allow the optimum aerodynamic forces and loads and avoid the vortices formed over the wing.

1.5.2. Wing fence

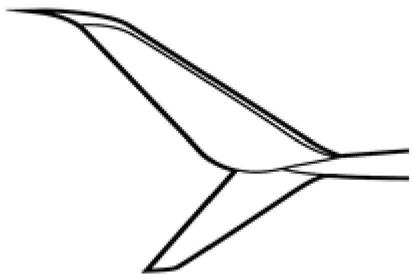

Fig. 3. Wing fence

Wing fence as shown in Figure 3 is the winglet that is redefined aerodynamic shape of the Blended winglet and it is also called split scimitar winglets. The combine configuration makes it corresponding range increase and also drags reduction. So long travel aircraft are using this type of winglet. It is mainly called boundary layer fence in swept-wing aircraft the wing fences are fixed flat plates at the upper surfaces parallel to the airflow typically wrapping around the leading edge. The entire wing is prevented by stalling as opposed to wingtip devices and also which increase aerodynamic efficiency and recover wing vortex energy.

1.5.3. Spiroid winglet

Fig. 4. Spiroid winglet

Spiroid winglet is the extension of the blended winglet of 360 degree is shown in Figure 4. It increases the lift at the wingtip by smoothing the airflow at the upper wing to the tip and reduces the induced drag because of wingtip vortices. This type of winglet increases fuel efficiency in powered aircraft and also increases speed in gliders and also in both cases increasing range.

1.5.4. Raked winglet

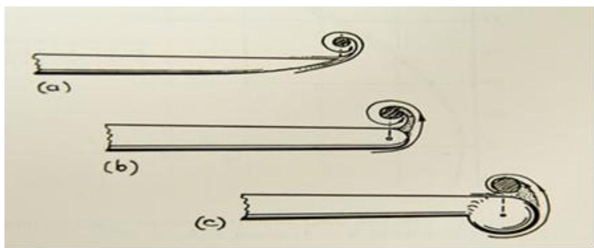

Fig. 5. Raked winglet

Raked winglet is the winglet that is modified shape from other conventional winglet as shown in Figure 5. The edge of the winglet is made slight curve shape different from the plane shape of winglet so that it is helpful increasing the fuel efficiency .It is used in for good take-off and climbing of the aircraft.

1.5.5. Upswept winglet

Upswept winglet is a type of blended winglet that has the function of spiroid and the blended performance to reduce the induced drag vertices. The shape of the winglet as shown in Figure 6, a curve over the wing to a some degree inward above the wing. It will increase the lift and long range ability of the aircraft at the curies.

Fig. 6. Upswept winglet

1.5.6. Drooped winglet

This type of winglet is same has the upswept winglet that the curve is some degree downward but some performance factors are opposite to the upswept winglet as shown in Figure 7.

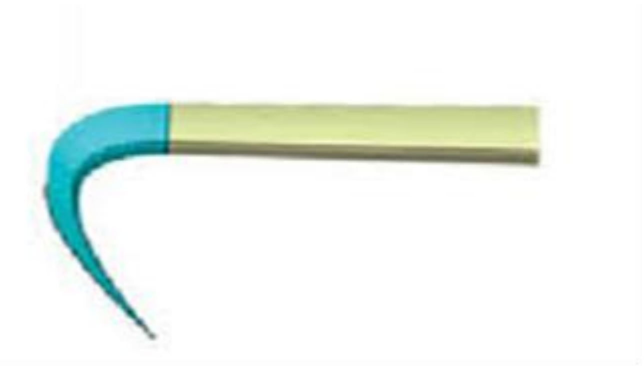

Fig. 7. Drooped winglet

1.6. State of the art

Ceiling fans has been used for many long years. However the air conditioners are used recently but ceiling fans are still used and achieving energy saving. There are various types of ceiling fan designs to perform task under different operating conditions. In that for increasing performance of the fan winglet is attached to the tip of the fan. hence, the research over the previous findings is taken into consideration and they are categorized in experimental study and numerical study.

Aravindkumar. N 2014[1] has done the work in outlining a wind turbine blade of length of 1.5 meters with suitable 2.0 kW little wind turbine. The utilizing the hyper works 11.0, then foreign into fluent the recreation setup could be begun. The arrangement of a moving reference edge gives the noticed point of rendering the transient nature of a turning issue a repairing issue. This proposes that the issue still shows good characteristics, along these lines, proper transient information to be given. This analysis was found to find the pressure acting on the fan and velocity created by the fan with the certain boundary condition.

E. Adeeb and a. Maqsood 2016 [2]had investigation testing the ceiling fan by shaping the winglet at the wingtip and calculating the aerodynamic performance of the fan .They have used tachometer to find the rpm of the fan. The setup carry with the fan at the center of the closed room and it is tested. The experimental setup is followed as all the researchers are taken placed. They have changed the wingtip angle 0, 12,6,4,8 and calculated the performance.

Francesco Babich and Malcolm cook 2017 [3] investigated for the Indian fan is kept inside a closed chamber. They tested airspeed, temperature in different ways by measuring above the floor at three level 0.1, 0.7 and 1.3m. They took 12 measurements for three times for the accuracy. They have made the experiment for finding the performance of the fan blade inside a closed room with the help of the anemometer kept at the center and changing the height for the calculation of the airflow at that height.

Fang Pan Zhong and Chao Zhou 2017 [4] investigated the winglet tip has the same suction side winglet and a pressure side winglet. The cascade profile was the blade geometry of a modern transonic high pressure turbine rotor. The main parameters of the cascade were meshing of the cavity tip. The computational domain uses one blade with periodic boundary conditions to simulate a row of blades. The pressure inlet and pressure outlet conditions are applied to the inlet and outlet of the domain. The uniform Intel parameter is given. The symmetry condition is set to the hub. To simulate the relative motion between the blade tip and the casing it set to be moving wall, because it is the effects of the centrifugal force and the coriol is force were much smaller than the effect relative end wall motion. The results presented from this part are obtained by numerical methods with relative end wall motion and all the flow field results are obtained based on the simulations with the blade and casing set as the adiabatic wall.

Alekhya N, N.Prabhu Kishore, Sahithi Ravi 2016 [5] investigated that the airfoils are shapes of the cross section of the wing developed by the national advisory committee for aeronautics. The blended winglet was attached to the wing in 300 angles and 900 angle .the analyses is done for all the three wings by giving the initial and boundary conditions as pressure inlet and velocity outlet to find the cd for each wing. The three wings was analyzed is the wing without winglet, wing with blended winglet and wing with circular winglet. The boundary conditions applied to the wing on winglet and also meshing of the boundary around the wing with winglet. The wings without winglet experiences high amount of induced drag. The winglets are placed at different angles with respect to wing to increase performance. The results obtained by placing winglets at 90° to the wing is achieve better performance of the wing instead of placing at different angles.

Muhammad Aaquid Afaq Adam Maqnood and Shahid Ikramullah 2017 [6] Conducted a experimental analysis in fan by changing the rank angle and bend angle of the blade by placing the fan at the center of the closed room of some measurement tested there power consumption, temperature, airspeed with the anemometers and also with tachometer for rotational speed and all the setup performance of the ceiling fan .this experiment was done for the investigating the indoor cooling and thermal comfort to reduce the power consumption and enhancing the energy efficiency.

Sheam Chyum Lin and M-Y Hsieh 2014 [7] has done testing on the ceiling fan with closed inlet and outlet with fan guard and with fan guard. they had found that with guard gives the high performance .in the fan guard they have calculated the blockage distance between the guard and also for the back guard gap calculation for the sucking of air to be delivered through the front guard. The testing is done inside a closed room to get the performance calculation to me more accuracy.

M. J. Smith and N. Komerath 2001 [8] has done an investigation on 7' x 9'tunnel of a NACA 0012 semi-span wing with 0.3 m 12 chord and a 1.219 m 48 span. The fan blade is placed inside the wing tunnel by fixed so that the wing root is 0.20 m above the floor. A short section of pipe and a disk placed on top of the pipe are used to fair the wing root. The 9 mm clearance between the wing and disc. The five winglets are flat aluminum plates of rounded leading edges. Mechanism at wing tip allows for adjustment of the angle of attack and the rotation of the wing tip. And they tested the performance of the winglet fixed at the wingtip.

Francesco babich and Malcolm cook 2017 [9] has done at the cfd simulation by taking ceiling fan has a momentum source and made the domain with the ring shaped fan that to down word direction and tested the structure with different domain chamber and calculated the temperature, velocity, circulation around the domain with the different simulation. Before main simulations a mesh sensitivity analysis is had completed with the purpose of estimating calculating the numerical uncertainty in the fine-grid and identifies the most suitable mesh for the main simulations. Three meshes of varying density had representing dimension to be calculated. The air speed at a point below the centre of the fan at 1.5m above the floor has been chosen. And calculated the performance.

Hesham S.M. Helal, Essam E.Khalil, Osama E. Abdellatif, Gamal M.Elhariry 2016 [10] Investigation on a blended winglet is attached to the wing with smooth curve instead of a sharp angle by this they have used smooth wing and winglets curves to reduce induced drag. The winglet they have used is spidol winglet and kept it at a perpendicular angle to get higher performance. Results for inflow conditions indicate that HAWT blades with sweep may be better in performance compared to their straight blade and the inflow cases such as turbulent wind with extreme shear, shorter's winglet blades received the highest better results because they produced lower loads on the wind turbine. The effect of blade and mesh resolution will vary dimensions for winglets and sweep and also adding more simulations with different wind speeds and turbulence flows.

The result of my investigation to the above reviews to higher the performance from the above experimental and analysis investigation there is many different types of winglets and there are made in single material and tested in differentangles. The designed material is analyzed in different method to prove the comfortable performance of the fan and the above results have found smooth curved edges and sweep winglet with perpendicular direction in a chamber gives high performance. Then the Experimental setup used in above experiments is very easy and it is used for the analysis to process the function and performance of the ceiling Fan.

2. Experimental Procedure

2.1. Design Modeling experimental

The experiment is made in a closed chamber because to avoid external forces that disturbs the airflow and the mechanical function of the fan. The Structure of the room is rectangle so; the chamber is symmetrical to both the axes. The size of the chamber is measured in meter has it is 4.87m x 3.54m length and breadth of the room. The height of the chamber is 2.77m and height of the fan to the floor is 2.46m. So the distance between the fan and the ceiling is 0.31m. The fan is present center of the chamber so the airflow will be equally distributed to all over the chamber through some parameter like velocity of air circulation, speed of the fan.

The center point of the fan is taken into consideration and made appoint at 1m and another at the 2m from the center point at the floor. The two points are considered has circular line around the fan. The airflow at the one point is considered has for whole airflow around the circular boundary.

The Fan has wing sweep of 1.2 m and angle sweep of 4 degree. Fan tip length of 8.5cm this specification is common for the entire exciting ceiling fan that are used in the college and home. For this type of fan the maximum of 74 watt power is consumed and given maximum of 320 RPM of speed.

2.2. Modelling analysis

The length of the fan blade is 1.2 m and the length of the tip is 8.5 cm so, considering the following aspects winglet is designed. The different types of the winglet are designed like blended winglet, wing fence type is designed and placed upward and downward of the wing tip and analyzed. Blended winglet is slightly modified with sharp edges and it nearly shaped like a triangular and also made shape of right angle triangular shape that are kept forward facing and also backward facing.

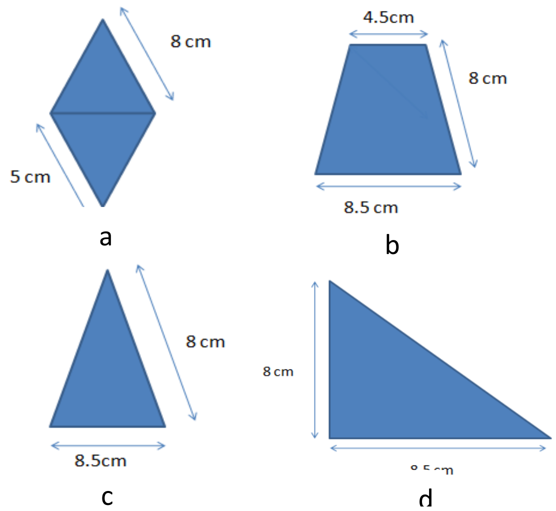

Fig. 8. Modelling Analysis (a. wing fence, b. Blended winglet, c. Sharp blended winglet, d. Blended winglet right angle

2.3. Set up conditions

Table 1. Experimental air speed of fan without winglet

Triangle Winglet (0 Degree)							
Fan speed	RPM	Airspeed m/s					
1	90	0.6	50%	0	0%	0	0%
2	96	0.8	14%	0.3	30%	0.1	10%
3	180	1	-9%	0.3	100%	0.1	10%
4	240	1.5	7%	0.6	200%	0.1	10%
5	290	1.6	6%	0.4	100%	0.1	10%

The table 1 represents the winglet rpm, airspeed, percentage of increase of performance than the ordinary fan. The speed change as per the rpm and the winglet function. The performance is analyzed step by step functional speed of the fan

Table 2. Experimental air speed of fan with right angle triangle winglet

Right Angle Triangle left side (0 Degree)							
Fan speed	RPM	Airspeed m/s					
1	80	0.5	25%	0	0%	0	0%
2	93	1	42%	0.2	20%	0.1	10%
3	183	1.1	0%	0.3	200%	0.1	10%
4	210	1.4	0%	0.4	100%	0.1	10%
5	290	1.9	26%	0.4	100%	0.1	10%
Right Angle Triangle left side(60 Degree)							
Fan speed	RPM	Airspeed m/s					
1	80	0.6	50%	0.1	10%	0	0%
2	93	1.1	57%	0.1	10%	0	0%
3	187	1.3	18%	0.2	100%	0.1	10%
4	250	1.6	14%	0.3	50%	0.1	10%
5	310	2.1	40%	0.4	100%	0.1	10%
Right Angle Triangle side (90 Degree)							
fan Speed	RPM	Airspeed m/s					
1	80	0.6	50%	0	0%	0	0%
2	93	1.1	57%	0.2	20%	0	0%
3	187	1.3	18%	0.2	100%	0	0%
4	250	1.6	14%	0.4	100%	0	0%
5	308	2	33%	0.4	100%	0	0%

Table 3. Experimental air speed of fan with triangle winglet

Triangle Winglet (0 Degree)							
Fan speed	RPM	Airspeed m/s					
1	90	0.6	50%	0	0%	0	0%
2	96	0.8	14%	0.3	30%	0.1	10%
3	180	1	-9%	0.3	100%	0.1	10%
4	240	1.5	7%	0.6	200%	0.1	10%
5	290	1.6	6%	0.4	100%	0.1	10%
Triangle Winglet (60 degree)							
Fan Speed	RPM	Airspeed m/s					
1	80	0.6	50%	0.2	20%	0	0
2	99	1.1	57%	0.3	30%	0.1	10%
3	181	1.2	9%	0.3	200%	0.1	10%
4	240	1.5	7%	0.3	50%	0.1	10%
5	292	1.8	20%	0.4	100%	0.1	10%
Triangle Winglet (90 Degree Downward)							
Fan Speed	RPM	Airspeed m/s					
1	72	0.3	-25%	0	0%	0	
2	93	1	42%	0.1	10%	0	
3	180	1.3	-18%	0.1	10%	0	
4	240	1.6	14%	0.3	50%	0	
5	289	2.1	40%	0.5	150%	0	

Table 4. Experimental air speed of fan with right angle winglet

Right Angle Triangle (0 Degree)							
Fan Speed	RPM	Airspeed m/s					
1	86	0.6	50%	0	0%	0	
2	93	0.9	28%	0.2	20%	0	
3	145	1	-9%	0.2	100%	0	
4	200	1.2	14%	0.2	0%	0	
5	211	1.6	6%	0.2	0%	0	
Right Angle Triangle (60 Degree)							
Fan speed	RPM	Airspeed m/s					
1	50	0.3	-25%	0.1	10%	0	0
2	94	1.1	57%	0.2	20%	0	0
3	180	1.1	0%	0.4	300%	0.1	10%
4	240	1.6	14%	0.3	50%	0.1	10%
5	289	1.8	20%	0.6	200%	0.1	10%
Right Angle Triangle (90 Degree)							
Fan speed	RPM	Airspeed m/s					
1	80	0.6	50%	0.2	20%	0	0%
2	93	1	42%	0.3	30%	0	0%
3	180	1.3	18%	0.3	200%	0.1	10%
4	240	1.7	21%	0.3	50%	0.1	10%
5	289	1.8	20%	0.5	150%	0.1	10%

The winglet above has high performance that improved the performance of the ceiling fan than the exciting ceiling fan. The dimension of the winglet is

Adjusted to the ceiling fan to make the airflow over the fan to move smoothly. This type of winglet has increased about 50% from the ordinary fan.

3. Results and discussion

3.1 Experimental analysis

As per the experimental chamber setup, Fan blade design and Winglet design setup is included for the experimental analysis. There winglets are designed with respected parameters and analyzed experimentally by attaching to the exciting ceiling fan. The attachment of the winglet is fixed upward and downward with different angles to analysis the best performance by the winglet to the normal ceiling fan also the different performance analysis within the winglet design. The angle fixed for the analysis are 0, 60, 90 degree. The experimental analysis includes the parameters like airspeed and the RPM of the ceiling fan. First at the chamber the ceiling fan is fixed with regulator and is checked whether it is in good operative condition. Assure that the ceiling fan placed at the centre of the chamber. In the next step the chamber should be in closed because to avoid the external disturbance.

Then the set measurement and fix the overall points to be measured by the anemometer. Placing the average point by the height so that the average airflow is measured. The average height point is considered has 1m, and place the anemometer at center point of the fan and taken the reading. Next reading is taken from 1m to the center point at the same height with the anemometer. Another reading is taken at 2m from the center point. The same process will be taken place for other type of the winglet.

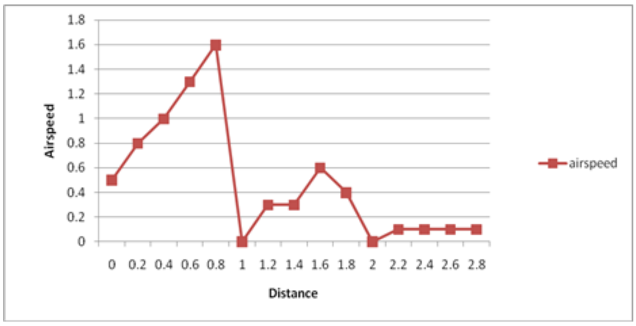

Fig. 9. Triangular zero degree

The triangle type of winglet is has the high performance than other winglet. The increase in airspeed is justified at the y – axis that the airspeed increase from 0.7 when compared to ordinary fan it is just 0.4m/s airspeed is achieved at the below tabulation the overall performance is clearly explained in graph.

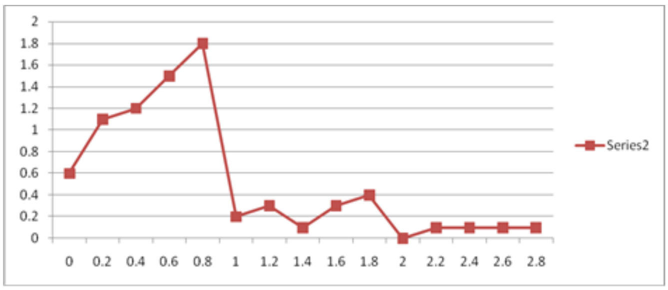

Fig. 10. Triangular 60 degree

The above graph is representing the performance of the winglet that is detached to the ceiling fan. The graph seems same but the performance of the fan change by minor variation. The performance change varies for the different winglet by induced drag created when moving at the tip of the winglet the vortex varies by the shape.

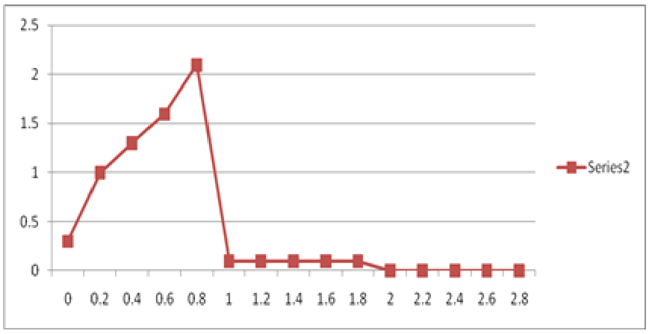

Fig. 11. Triangular 90 degree

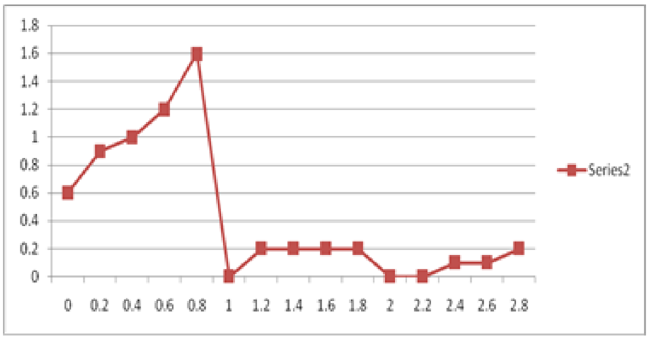

Fig. 12. Right Angle Triangle Zero Degree

Here in this graph the winglet airspeed from 0.6 and it is nearly similar to the ordinary ceiling fan the function of the fan is disturbed by the shape that make the vortex to make drag that reduce the airspeed.

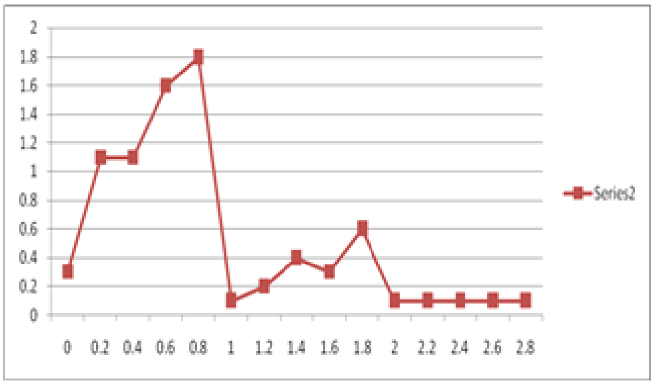

Fig. 13. Right Angle Triangle 60 Degree

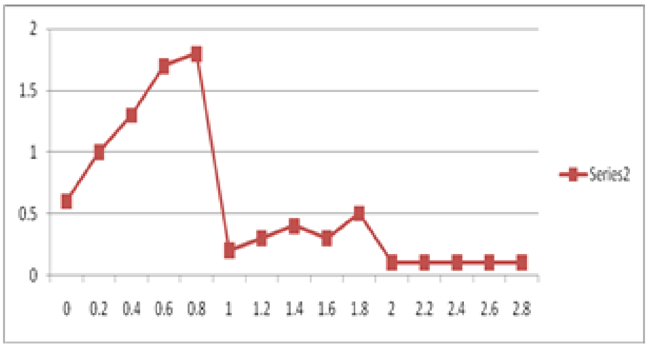

Fig. 14. Right Angle Triangle 90 Degree

In this type of winglet the airspeed increases and makes some smooth level of airspeed that starts from 0.7 and make a curve to 2 at the initial level. The airspeed of the winglet attached to the fan is critically increased than ordinary fan.

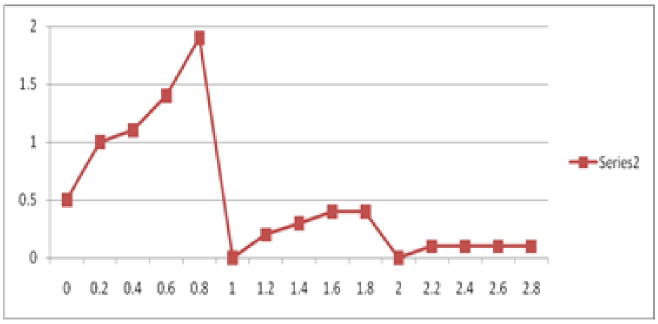

Fig. 15. Right Angle Triangle Left Zero Degree

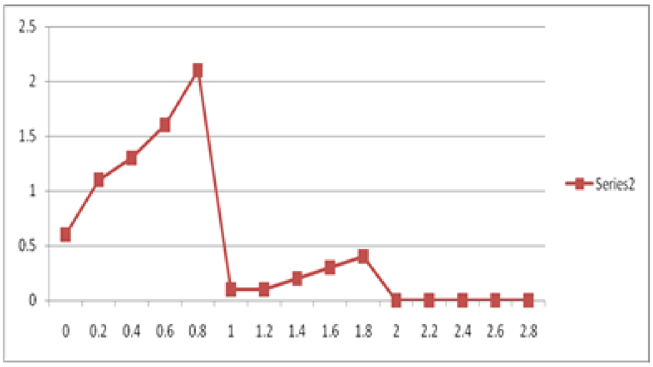

Fig. 16. Right Angle Triangle Left 60 Degree

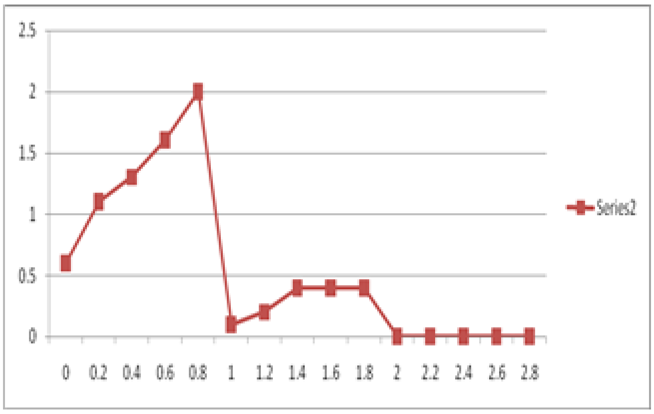

Fig. 17. Right Angle Triangle Left 90 Degree

3.2 Analysis of graphic results

The different types of winglet is used in the same kind of the ceiling fan and found the performance of the fan with respect to the airspeed. The performance is based on the airspeed of the ceiling fan when the winglet is attached and with the winglet attached. In the winglet the change in angle of the winglet will also affect some change in the performance of the winglet. There are different types of winglet from that blended sharp winglet has best performance because the reduction of the induced drag is higher than the other winglet.

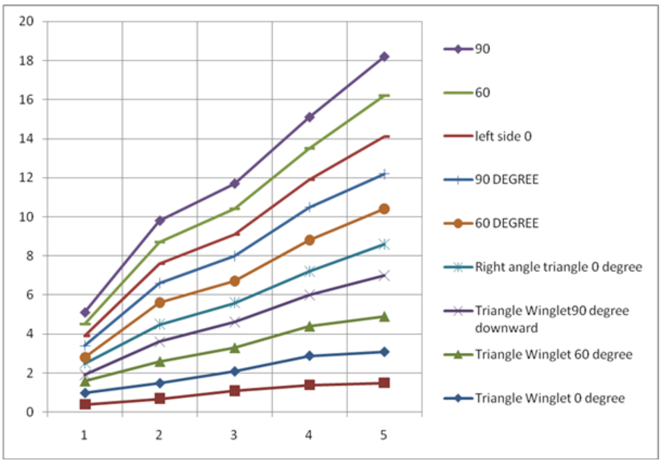

Fig. 18. Airspeed vs distance inn floor

From the above Tabulation, The performance for the winglet is calculated by taking ordinary fan has reference. The performance of the winglet attached to the ceiling fan is taken percentage. To the above tabulation certain graph is plotted and the performance is increased and decreased as per the above reading. The performance of the winglet is mainly based on the Above Graph is plotted to x-Speed of the Fan and in y- Distance at the floor from the centre of the fan. "The Design and Testing of a Winglet Airfoil for Low-Speed Aircraft", AIAA Paper 2001-2478

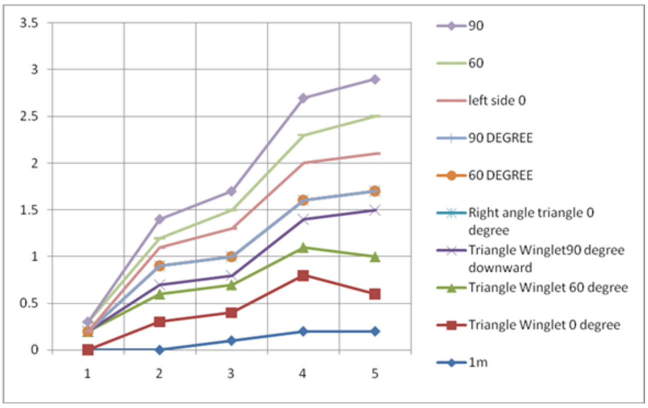

Fig. 19. Airspeed vs distance in floor

Above Graph is plotted to x-Speed of the Fan and in y- Distance at the floor from the centre of the fan.

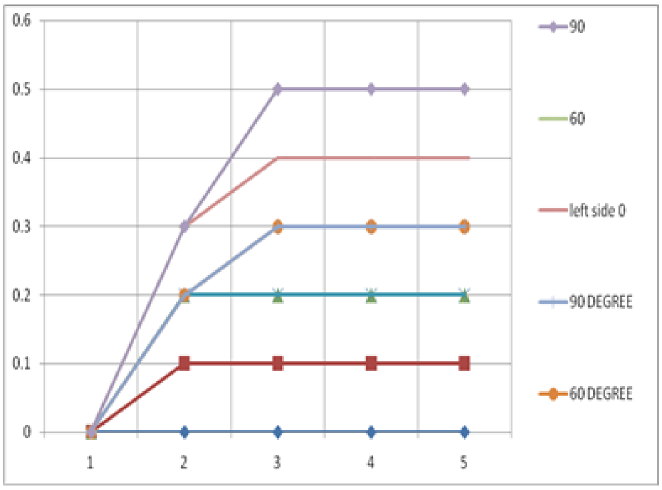

Fig. 20. Airspeed vs distance in floor

The above graph represents the overall performance of the winglet by increasing in airspeed has per the speed rate of the ceiling fan. The performance of the winglet is changed has per the angle of the winglet kept at the edge of the ceiling fan.

3.3 *Analysis of case study*

The Performance of the fan when attached to the winglet is made study with different types of winglet design and taken airspeed using anemometer and compared within the winglet performance and chosen the best winglet to make detached to the exciting ceiling fan. The winglet is kept fixed to the winglet; the winglet is changed after taking performance reading. The performance is taken as the airspeed using the anemometer. The fan speed is changed and made note on the airspeed and made same analysis to the other winglet at the same fan. Then the same functional analysis is made at the other different fan model.

The wing Fence (Fig 8.a) winglet is having the low performance when compared to other winglet because the winglet in 90 degree upward and 90 downward so that the lift is produced upward. It is producing high pressure downward and low pressure upward. So the airspeed produced will decrease. Because of this the blade get vibrated and create damage to the ceiling fan.

The Blended winglet has high performance when compared to other winglet at the angle of 60 downward it produce more life downward. So that the pressure will be produced upward to increase the airspeed downward. It decreases the vibration than the wing Fence.

The sharp edge blended winglet is the best performance delivered than the other winglet. It has sharp edge so that it can reduce the induced drag more than the other. The performance is compared within the angle winglet when kept in different angle 0, 60, 90 degrees from the edge of the fan blade. (Fig8.a). In that the winglet is made right angled triangle shape and calculated and compared with different angle. Performance of the winglet is different from each other.

The winglet like Hoerner, spiroid wing grid, raked winglet has same performance has the ordinary fan because the shape of the winglet does not change or decrease the performance of the fan. Because the angle of the fan blade is not changed according to the winglet. The change in angle of the fan blade may increase the performance of that type of winglet.

4. Conclusions

The Experimental Analyses of winglet attached to the ceiling Fan to reduce the induced drag is successfully done and proved as per the Experimental reading calculation. The Airspeed total percentage of the sharp edge blended winglet is 60 percent increased than the ordinary fan. Then the right angle triangle blended winglet has 40 percent from the ordinary winglet. Some winglet like Wing Fence, Wing Grid has no increase in the performance. Some winglet decreases the performance of the ordinary fan and damage the fan. But in all cases the sharp edge winglet makes the performance high it is taken to detach externally to the exciting fan. From the above graph and the table the project is concluded with the sharp edge blended winglet for detaching with the ceiling fan. Future works may study on the Detachment method of the winglet to the exciting fan, selecting the material for the winglet, different types of winglet to different types of fan. The detaching method is the difficult scenario to place a winglet at the exciting ceiling fan. The material should be chosen as per the detaching method.

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