Abstract— introduction in today’s world the need

Engineering

Abstract— The turbine is specially constructed so as to mimic the bio-mechanics of birds’ wings in order to develop electricity. It consistsof flapping blades which are connected via a mechanism to a motor. The turbine is also equipped with solar cells in order to add to theelectricity generated and also to help generate electricity when wind velocity is low. This project was initiated keeping in mind the fact thatthe large dimensions of current turbines occupy large space and thus have reduced application in urban areas. This project aims to makethe current turbine design compact and aims to utilize a new design for wind energy generation.

Index Terms— Drag, Flapping, Wind, Wing, Solar, Turbine——————————? ——————————1 INTRODUCTIONIn today’s world the need for renewable resources is on therise as the availability of conventional resources like petroleumand coal reduces. Although wind energy has been utilizedsince ages the current design of the wind turbines requires alot of space and the large rotating blades pose a threat to thebird population in areas where they are installed. Also theseturbines are dependent purely on air flow as their primarysource of energy thus making the current design less efficient. Another drawback of current designs is that the density ofsuch turbines is very limited as they cannot be installed veryclose to each other thus affecting net power output per sq.

marea. The project aims to use the combination of wind as well assolar energy to generate electricity . The flapping wing design(similar to that observed in birds during flight) helps to makethe wind turbine compact. The flapping wings motion is thenconverted into rotary motion to generate electricity. Additionallyby mounting solar panels on the outer periphery of

thecentral hub helps add to the electricity generated thus improvingthe energy output per turbine. 2 DESCRIPTIONThe wind turbine design is particularly inspired by the flappingmotion of a humming bird. The path traced by the hummingbird’s wing during hovering follows the shape of an infiniteloop.

This path is ideal for flapping as the amount ofvibrations transmitted to the supporting structure are the leastthus giving more stability to the entire structure. The mechanismdeveloped for the wind turbine is tuned to trace the infinitepath so that the flapping occurs in a similar manner tothat of a humming bird. Ideally the power output can be maximized if the entire wingis manufactured fabricating solar cells directly onto the surfaceof the wing but due to the current costs incurred for this processare high using an external solar cell mounted on the mastof the wind turbine is the feasible option. So this design aimsto utilizing two techniques of electricity generation using renewableresources and fusing them together to develop a relativelynew method of energy generation. 3 HISTORYThe first known practical wind power plants were builtin Sistan, an Eastern province of Iran, from the 7th century. Wind power first appeared in Europe during the Middle Ages. The first historical records of their use in England date to the11th or 12th centuries and there are reports of Germancrusaders taking their windmill-making skills to Syriaaround 1190.

By the 14th century, Dutch windmills were inuse to drain areas of the Rhine delta. The environmental impact of wind power when compared tothe environmental impacts of fossil fuels is relatively minor. There are no direct greenhouse gas emissions from the generationof electricity using wind

turbines, and every 1 MWh ofelectricity generated by a wind turbine results in a drop of 0.

8-0. 9 t in greenhouse gas emissions when compared to a powerplant using conventional fuels. 1These benefits have propelledthe efforts of improving wind turbine technologies thusimproving their efficiency and net power output. Worldwide there are now over two hundred thousand windturbines operating, with a total nameplate capacity of432 GW as of end 2015. As of 2011, 83 countries around theworld were using wind power on a commercial basis. The sizeof wind turbines has multiplied over the past 25 years and 5MW wind turbine rotor has a diameter of up to 130 meters.

Likewise, the tower height of the power plants has increasedfrom 22 meters to over 140 meters.——————————————————Omkar Bhogale, Mayank Dedhia and Tanmay Dhuri are currently pursuingBachelors’ degree in Mechanical Engineering at Thakur College of Engineeringand Technology, Mumbai, India. International Journal of Scientific & Engineering Research, Volume 8, Issue 1, January-2017ISSN 2229-5518IJSER © 2017http://www. ijser. org4 WORKINGHumanity has been studying and borrowing designs and solutionsfrom the surrounding nature for many years.

In the sameway we are trying to design and replicate the flying motion ofhummingbirds which allows them to fly and hover at thesame position. Instead of three spinning blades that take up a lot of space andneed to be installed high off the ground, the turbine uses apair of wings that move back and forth in a figure-eight motionin the breeze. 3The wind will force the

wings to move in figure 8 which is a toand fro motion. It is further converted to rotational motiondue to the mechanism (Fig C) and design of the turbine.

Lift Force: The lift force is one of the major force componentsexerted on an airfoil blade section inserted in a moving fluid &acts normal to the fluid flow direction. This force is a consequenceof the uneven pressure distribution over the blade surfaces. Fig(a) Fig(b)Force analysis of wing bladeFig (c)-Proposed mechanism in order to convert the flappingmotion to rotary motion. Fig(d)-Proposed blade design for wing-T. VDuring down stroke phase (A to B) and upstroke phase (C toD), the wing moves following 8 figure trajectory and convertsthe totality of the resultant R (Drag+Lift). The resultant R remainsalways tangential to the wing’s trajectory.(Fig.

a andFig. b)During the 2 short phases (D to A) and (B to C), the aerodynamicresistance is quasi nil since the angle of attack becomesequal to zero. Different types and design configurations (Fig d) for windturbine: A great degree of design versatility is available in thewind turbines design configurations. There are a few problemsinherent to the currently available designs including lowstarting torque, turbine blade lift forces, lower efficiency, poorbuilding and foundation integration, etc.

The drag force acts in the direction of the fluid flowing. Dragoccurs due to the viscous friction forces on the airfoil surfaces, and the unequal pressure on surfaces of the airfoil. Drag is afunction of the relative wind velocity at the rotor surface, which is the difference between the wind speed and the speedof the surface. 5 FLAPPING WING MECHANISMIdeally the proposed mechanism would provide the mostcompact solution to attain the flapping

motion but due to theincreased surface contact the losses occurring due to frictionwould be much greater.

So the mechanism to achieve the infinitepath is designed based on a concept called, Duke Engine. It is an axial engine mechanism where the reciprocating motionof pistons is converted to rotary motion using an inclinedcrank. This mechanism is ideal as first and second order vibrationsare negligible which make the system much more stable. 5The proposed mechanism helps to achieve the flapping motionin the required infinite path and thus ensures stability ofthe entire structure. International Journal of Scientific & Engineering Research, Volume 8, Issue 1, January-2017ISSN 2229-5518IJSER © 2017http://www. ijser. orgFig (c)-Actual mechanism in order to convert the flapping motion torotary motionThe mechanism we have developed consists of a circular arrangementof pistons held in a cylindrical block. Each pistonhas two connecting rods at both ends attached by ball joints.

At the top the flapping wing is attached to the piston rods. Atthe bottom each connecting rod is attached to a disc which isfurther attached with an inclined connection rod. This rodhelps in rotating the drive shaft. Thus the sequence of motionis as follows: Flapping to Reciprocating to Rotary. The use of auniversal joint at the center of the supporting disc helps toensure that at whatever angle the dice is rotation the power isalways efficiently transmitted to the drive shaft.

Using the balljoints at each ends of the connecting rods helps in smoothlyachieving the flapping motion without straining any componentsof

the mechanism. This prototype is inspired by theDuke Engine mechanism and it is adapted and modified tosuit the requirements of the wind turbine. 6 INDUSTRIAL APPLICATIONProject has utility in the energy sector. The design allows theturbine to be compact. Combination of two sources helps toimprove the power output. With this unique Bio design, verticalaxis converters could be widely adopted across variousareas including onshore and offshore They could be installedfor individual use (eg. to power a house) or grouped in a largewind farm. We are aiming to achieve at least 5kW power generationfrom each turbine purely on wind power.

Additionallydeploying the solar panels would help jump the power outputby another 2kW thus making the expected output reach 7kW. Since this project involves the synergistic combination of twovery different technologies to generate electricity it’s a completelynew approach towards energy generation from renewablesources of energy. Also the design of this wind turbine isvery compact allowing it to be installed in very tight spaces. Considering this the density of turbines in per sq. meter areacan be increased thus giving higher electricity generation rate. 7 CONCLUSIONThe project is a novel approach towards energy generationand we are trying to implement a new design in more efficientand compact form. The flapping design helps to mimic the biomechanics of birds hence birds are also alerted and the fatalitiesto birds can be significantly reduced. The higher density ofturbines per sq.

metre means that the net power output can beincreased than a conventional wind turbine. The flapping motioninspired by humming birds and the mechanism utilizedensure that the vibrations transmitted are least and thus

theturbine can be safely installed atop buildings and skyscrapersin urban areas. The combination of solar cells with wind powermeans that higher power output in relatively less space. Thus the flapping wing wind turbine is the viable alternativeto conventional wind energy technologies. 8

REFERENCES1 2013: VTT Technical Research Centre of Finland. (in Finnish) – summary atend of document2 Bolin K et al. Infrasound and low frequency noise from wind turbines: exposureand health effects.

Environmental Res Let 20113 Altamont Pass Wind Resources Area (APWRA) Conservation Plan. http://www. apwraconservationplan. org/index.

html. accessed June 20114 Wind turbine paper – AIMU PAPERS5 ISSN(Online): 2347-3878, ImpactFactor(2015): 3. 791(http://www. ijser. in/archives/v4i10/IJSER15974. pdf)6 William McKinneyandJames DeLaurier. “ Wingmill: An Oscillating-WingWindmill”, Journal of Energy, Vol.

5, No. 2 (1981), pp. 109-1157 Duke Engines-New Zealand