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A FABRICATION MODEL OF SILENCER BASED POWER GENERATION

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Abstract— ***The project aimed at developing a system which is capable of generating energy from the air pressure that comes out from the vehicle's silencer. The alternative forms of available energy constituted a substantial range and more forms are being discovered. This silencer based power generation is a low cost system and lots of energy can be generated from these days in the available vehicles with no additional damages to the nature. The project used an air foil blade of turbine and silencer setup. The air pressure from the silencer will be fallen on the air foil blades of the turbine and rotate the turbine fan blade, which is connected to a DC generator through the rotor shaft. In turbine, the wind energy is converted to mechanical energy. The mechanical energy produced in turbine is again converted to the electrical energy as DC power. The energy produced in DC generator by electromagnetic induction mechanism is stored in rechargeable battery for rural electrification. This stored energy in the rechargeable battery is fed to an inverter, which is to DC power converted to AC power. The generated AC power supply in the inverter is sent to the AC load switching like bulbs or any home appliances. The major features of this project are alternative form of energy generation, silencer based power generation, power storage into rechargeable battery, AC load switching from rechargeable battery, finding the effective directions and positions of turbine, comparing the voltage readings of blower setup and bike setup power generation at particular speed and calculating the voltage readings of speed variation in bike setup. The major building blocks of this project are silencer setup, turbine blade, DC generator, rechargeable battery, inverter, bulb and multimeter. The aimed project "A Fabrication Model of Silencer Based Power Generation" is fabricated such that turbine power generation from silencer air pressure and used the power for rural electrification. The optimum voltage reading of blower setup and bike setup at 3000rpm speed have shown that the best and effective direction and position of wind turbine is at X-axes in 180^0 position for high power generation in DC generator. The voltage readings of the different increasing speeds in bike setup at X-axes in 180^0 position of wind turbine are also noted. The maximum power generated at various speeds of bike setup is 4.58 volts at 5000rpm. It is concluded that the effective direction and position of wind turbine is X-axes at 180^0 position in blower setup as well as in bike setup. It is also concluded that maximum power generation of X-axes turbine column direction and turbine fan at 180^0 position of different increasing speed of bike setup is at 5000rpm economic speed. Integrating features of all the used hardware components has been developed in it. Every module has been reasoned out and carefully placed and also contributed to the best working unit. With the help of growing technology, the highly advanced IC's are used in the project. The project has been successfully implemented. Thus the project has been successfully fabricated and tested.***

Keywords: -Fabrication, silencer, power, generation and model.

1. INTRODUCTION OF ENERGY

Energy is defined as the capacity required for performing the work. It is quantitative property, which is transformed to perform on or to heat the object. It is also conserved quantity. According to conservation of energy law states that energy can be converted but not created or destroyed. The energy unit in SI unit is JOULE.

The main sources of energy are existed from the natural resources. Broadly, natural resources are divided into two types. They are renewable and non renewable resources. The respective produced energies of renewable and non renewable resources are Renewable energy and Non renewable energy.

Renewable energy is defined as the energy occurs from the renewable resources. Renewable resources means the resources replenish naturally such as geothermal heat, waves, tides, rain, wind and sunlight. The electricity generation, air and water cooling/heating, rural energy services and transportation. Most of the renewable resources are used to provide electricity. This energy becomes cheaper and efficient .Total energy consumption of renewable systems increases because of cheaper and efficient. The types of renewable energy are solar energy, wind energy, geothermal energy, tidal energy, wave energy, hydro energy, biomass energy and bio-fuel energy.

Non renewable energy is defined as the energy produced from the non renewable resources like fossil fuels and nuclear fuels. The non renewable resources means the resources are not replenish naturally such as fossil fuels and nuclear fuels. It is also known as finite source because it cannot be renew itself to sufficient amount.

2. REVIEW LITERATURE

Investigation and design optimization of thermoelectric generator (TEG) performed by Jing Hui Meng, Wei Hsin chen and Xio Dang Wang. It is applied in automobile exhaust waste heat recovery. In this, exhaust heat source and water cooling heat sink are modeled.

Gregory P Meisner developed the study of thermo electric materials for the development of TEG in order to recover the automotive waste heat. The overall heat transfer, the output of electrical power and pressure drop for the exhaust gas inlet conditions and available TEG volume. S Prateebha experimented on the exhaust use from any engine in order to generate the power using TEG.

Young Kim, Gyubaek Cho and Assmelash A Negash experimentally invested the performance of waste recovery of TEG. Rectangular exhaust gas channel were installed in lower side and customized thermoelectric modules (TEM) at upper side. The cooling tower water at ambient temperature is supplied and also used to create temperature difference between each TEM. For maximizing the TEG power output, the diesel engine is operated at various conditions. It was observed that TEG power increases with engine load or speed. The maximum power was approximately 119W at 2000 rpm with a BMEP of 0.6 MPa. The energy conversion efficiency was 2.8% and pressure drop found to be 0.45– 1.46 KPa under all engine operation conditions.

J.Emeema did experiments on power generation using two wheeler silencer based on the pressure of exhaust gas exits from bike silencer. The aluminium turbine is used and kept in front of the silencer, where the exhaust gas pressure will fall on the blades of turbine to spin. The aluminium turbine is star in structure. S.Vijaya kumar, Amit kumar singh, Athul sabhu and Mohammad Farhan P did experiments on exhaust gas pressure basis from bike silencer. The turbine used in their experiment is 25 blades roof top exhaust fan type. They shown the relationship between produced current and engine speed.

Y.D. Deng, X.Y.Wang, C.Liu, P.Wang and C.Q Su designed heat exchanger for TEG of automotive exhaust system. They evaluated the properties of thermal and pressure losses of heat exchanger. After optimization, the horizontal temperature differences are reduced and average temperature s are improved from 222.46 degrees to 226.4 degrees Celsius whereas longitudinal temperature difference is decreased from 29.3 degrees to 28.9 degrees Celsius. The pressure decreased approximately to 20%, which is significant for overall improvement of TEG.

3. EXPERIMENTAL SETUP

In olden days, people use bullock carts or horses to transport from one place to another place to reach far places. Later, automobiles came into existence to transport from one place to other to reach safe and early compared to bullock carts or horses. Now-a-days, a huge number of vehicles are used for transport. Every automobile releases smoke, which contains flue gas and particulate matter after combustion. If the combustion is uneven condition then the emissions or smoke from the silencer is more compare to normal combustion condition. Smoke pollutes the environment, which contains toxic and harmful gases like CO, NO_X, CO_2 and HC gases. So many research and technologies are going to decrease the emissions. Emissions have high temperature and pressure flue gases, which pollute the environment. So, emission should be either controlled in order to protect the environment or used to generate the power if emission control is not possible. Some technologies came into existence to develop power through the high temperature of emissions by using peltier effect. In this project, emissions or exhaust gases pressure from silencer discharge are used to generate the power. The working procedure of experimental setup is done in two ways in the fabrication setup. They are to charge battery and bulb glowed from battery source.

To charge battery: There are two methods to charge the rechargeable battery. They are using turbine power and using power supply.

Using turbine power: The blower outlet is connected to silencer. Adjustment stands are used to hold the blower and silencer as shown in figure. The air foil turbine is kept in front of the silencer outlet. The turbine is placed on rotor shaft of DC generator. The DC generator outside wiring is connected to rechargeable battery through charging circuit. When the blower is switched on, the air blows out by centrifugal force in the blower with pressure. The air pressure of blower is enters into the silencer. The baffles in the silencer increase the air pressure by obstructing the air from blower. The high pressure of air is fallen on the air foil blades of wind turbine to rotate with speed. The wind turbine is connected to the rotor shaft of DC generator. In DC generator, mechanical energy is converted to pulsating DC when wind turbine is in rotation. The turbine power produced in the DC generator is observed by LED glowing as shown in figure.

Fig.1. LED glows with Turbine power

The pulsating DC is sent to the charging circuit by external wiring connected from DC generator to charging circuit. The charging circuit is used to convert pulsating DC into pure DC. In charging circuit, a bridge full wave rectifier is used to convert the negative phase pulsating DC into positive pulsating DC. Again positive pulsating DC is converted into pure DC by using diode and resistance in charging circuit. The pure DC from charging circuit is sent to the rechargeable battery to charge.

Fig.2. Turbine power charging the battery

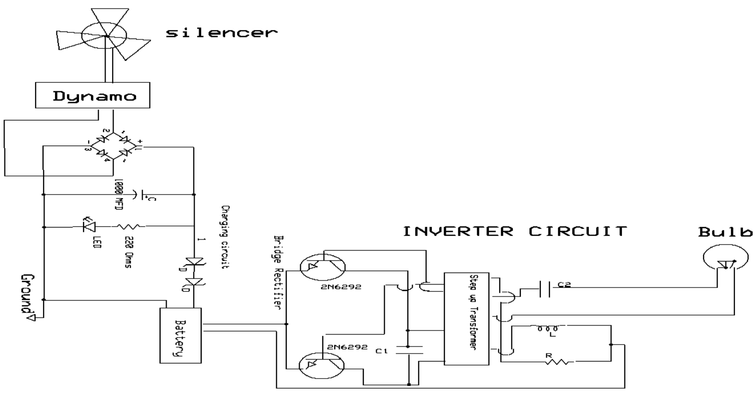

Fig.3. Line diagram of circuit connections

Using power supply: The plug of transformer is kept in connection with AC supply wires by a switch. The transformer output is connected to input of charging circuit. Charging circuit consist full wave bridge rectifier, diodes and resistance for converting the pulsating DC power to pure DC. The charging circuit is connected to the rechargeable battery. It is another method to charge the rechargeable battery by electricity as input source. The AC power supply is passed in the wiring of transformer by plug switching on the switch. The transformer converts AC power supply to pulsating DC. The transformer is connected to the charging circuit, where pulsating DC converts to pure DC. In charging circuit, two conversions are done. They are negative phase pulsating DC to positive pulsating DC held in full wave bridge rectifier and positive phase pulsating DC to pure DC held by diodes and resistance.

The pure DC from the output of charging circuit is sent to the rechargeable battery for charging purpose. This process is done up to 6 to 8 hours per day to get fully charged. LED glows when the 12 volts current passes in the charging circuit. LED is in series connection with resistance to denote the power flows. In charging circuit, the main usage of diodes is to flow the current in one direction whereas the resistance makes the adjustment of pulsating DC signals.

Fig.4. Power supply charging the battery

Bulb glowed from battery source: The rechargeable battery is connected to the inverter, which contain capacitors, MOSFET, transformer and rheostat. The inverter is then connected to batten holder, where the bulb is placed. The pure DC power in 12 volts rechargeable battery is sent to the 50 watts circuitry board or inverter, where the pure DC is converted to AC power supply. The inverter is again connected to the batten holder of bulb with switch. When the switch is on the bulb glows or else it is in off state.

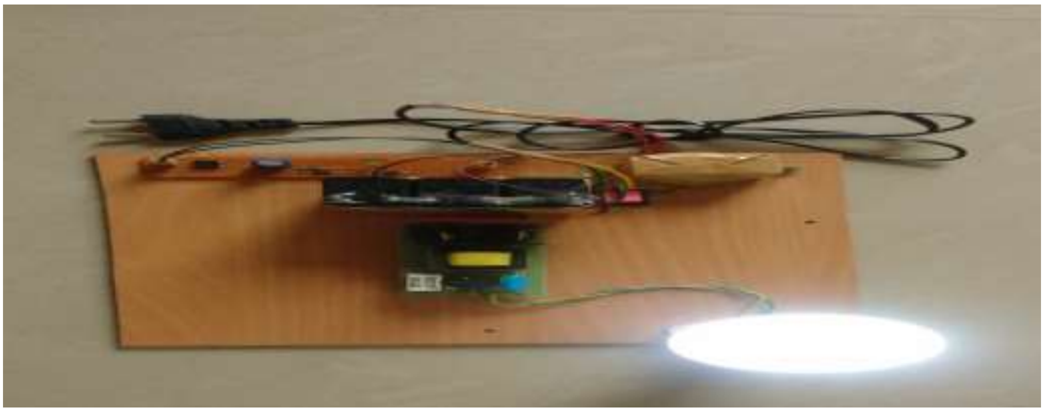

Fig.5. Battery source bulb glowing

The experimental procedures are done in two ways based on blower setup and bike setup. An experiment is also done in effective axes direction at effective position of wind turbine for different speeds in bike setup. The effective axes direction and effective position are determined by seeing the optimum voltage readings from **table4** and **table2** of appendix of blower setup and bike setup.

Blower setup: The experiment on blower setup is done basically to determine the voltage readings at constant speed i.e., at 13000rpm in enclosed place, where absence of air force. The absence of surrounding air force will lead to give the effective rotation of wind turbine and gives effective voltage readings in multimeter. In blower setup, blower is connected to silencer. The air foil blades of wind turbine are placed in front of silencer outlet. The turbine fan is connected to the rotor shaft of DC generator. The output of DC generator external winding is connected to the multimeter through probes.

Fig.6. Blower setup with multimeter

When the blower is switched on, the air blows out with centrifugal force and enters in the silencer. In silencer, baffles obstruction will increase the air pressure. The air pressure of silencer outlet will fall on the air foil blades of wind turbine. The rotation of wind turbine occurs and power is generated the DC generator. The voltage readings are observed in the multimeter, when the turbine fan rotates in clockwise direction gives the positive sides of voltage readings. The voltage readings are noted in the different directions at different positions of turbine. The different directions are as follows based on axes are X-axes, Y-axes and Z-axes.

X-axes: The turbine column is placed in x-axes direction and air foil blades of turbine are placed in front of the silencer outlet in such a way that the blades rotates in clockwise direction. The clockwise rotation of turbine gives the positive side voltage readings. In X-axes direction of turbine column at 0^0 position, the turbine fan is kept above the column. When the blower is switched is on, the air blows out through silencer with pressure will fall on the air foil blades of turbine. The rotation of turbine fan should be in clockwise and power produces from the DC generator. The voltage reading is noted from the multimeter. The above process is repeated for other two times. The voltage readings are noted from multimeter for respective process repetition. The voltage readings are noted and also average of the three readings is also done and noted in the **table1** of appendix.In X-axes direction of turbine column at 90^0 position, the column is rotated at an angle 90^0 from the 0^0 position in anticlockwise direction. When the blower is switched on, the air blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation should be in clockwise at effective place to record the optimum voltage reading from the multimeter occur through power generation in DC generator. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table1** of appendix. In X-axes direction of turbine column at 180^0 position, the column is rotated at an angle 90^0 from the 90^0 position in anticlockwise direction. In this position of turbine, the turbine fan is below to the turbine column. When the blower is switched on, the air blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation should be in clockwise at effective place to record the optimum voltage reading from the multimeter occur through power generation in DC generator. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table1** of appendix. In X-axes direction of turbine column at 270^0 position, the column is rotated at an angle 90^0 from the 180^0 position in anticlockwise direction. When the blower is switched on, the air blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation should be in clockwise at effective place to record the optimum voltage reading from the multimeter occur through power generation in DC generator. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table1** of appendix.

Y-axes: The turbine column is placed in y-axes direction and air foil blades of turbine are placed in front of the silencer outlet in such a way that the blades rotates in clockwise direction. The clockwise rotation of turbine gives the positive side voltage readings. In Y-axes direction of turbine column at 0^0 position, the column is at vertical direction and turbine fan is faced in front to the silencer outlet. When the blower is switched on, the air blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation is not takes place at this position and no power generation in the DC generation. The voltage reading from the multimeter is zero because no rotation of turbine. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table1** of appendix. In Y-axes direction of turbine column at 90^0 position, the column is rotated at an angle 90^0 from the 0^0 position in anticlockwise direction. When the blower is switched on, the air blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation should be in clockwise at effective place to record the optimum voltage reading from the multimeter occur through power generation in DC generator. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table1** of appendix. In Y-axes direction of turbine column at 180^0 position, the column is at vertical direction rotated an angle 90^0 from 90^0 position in anticlockwise direction and turbine fan is faced behind to the silencer outlet. When the blower is switched on, the air blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation is not takes place at this position and no power generation in the DC generation. The voltage reading from the multimeter is zero because no rotation of turbine. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table1** of appendix. In Y-axes direction of turbine column at 270^0 position, the column is rotated at an angle 90^0 from the 180^0 position in anticlockwise direction. When the blower is switched on, the air blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation should be in clockwise at effective place to record the optimum voltage reading from the multimeter occur through power generation in DC generator. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table1** of appendix.

Z-axes: The turbine column is placed in z-axes direction and air foil blades of turbine are placed in front of the silencer outlet in such a way that the blades rotates in clockwise direction. The clockwise rotation of turbine gives the positive side voltage readings. In Z-axes direction of turbine column at 0^0 position, the turbine fan is above the turbine column. When the blower is switched on, the air blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation should be in clockwise at effective place to record the optimum voltage reading from the multimeter occur through power generation in DC generator. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table1** of appendix. In Z-axes direction of turbine column at 90^0 position, the column is rotated at an angle 90^0 from the 0^0 position in anticlockwise direction. When the blower is switched on, the air blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation is not takes at this position and no power generation in the DC generator. The voltage reading from the multimeter is zero at this position because no turbine rotation. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table1** of appendix. In Z-axes direction of turbine column at 180^0 position, the column is rotated at an angle 90^0 from the 90^0 position in anticlockwise direction. When the blower is switched on, the air blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation should be in clockwise at effective place to record the optimum voltage reading from the multimeter occur through power generation in DC generator. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table1** of appendix. In Z-axes direction of turbine column at 270^0 position, the column is rotated at an angle 90^0 from the 180^0 position in anticlockwise direction. When the blower is switched on, the air blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation is not takes at this position and no power generation in the DC generator. The voltage reading from the multimeter is zero at this position because no turbine rotation. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table1** of appendix.

All voltage readings at constant speed 13000rpm of blower setup in table1 are converted and calculated to 3000rpm speed of blower voltage readings. The respective voltage readings at different directions of turbine column and positions of turbine fan are noted in **table4** at 3000rpm speed of blower.

Bike setup: For testing, a 150cc engine Bajaj Pulsar is considered. The experiment on bike setup is done basically to determine the voltage readings at constant speed i.e., 3000rpm in an open place, where surrounding air force presence. The presence of surrounding air force will leads to give the irregular rotation of wind turbine and gives voltage readings variation in multimeter.

In bike setup, an IC engine is connected to silencer in order to blow the exhaust gases. The air foil blades of wind turbine are placed in front of silencer outlet. The turbine fan is connected to the rotor shaft of DC generator. The output of DC generator external winding is connected to the multimeter through probes.

Fig.7. Bike setup with multimeter

When the bike engine is switched on, the flue gases blow out with a force after combustion and enters in the silencer. In silencer, baffles obstruction will increase the gas pressure. The gas pressure of silencer outlet will fall on the air foil blades of wind turbine. The rotation of wind turbine occurs and power is generated the DC generator. The voltage readings are observed in the multimeter, when the turbine fan rotates in clockwise direction gives the positive sides of voltage readings. The voltage readings are noted in the different directions at different positions of turbine. The different directions are as follows based on axes are X-axes, Y-axes and Z-axes.

X-axes: The turbine column is placed in x-axes direction and air foil blades of turbine are placed in front of the silencer outlet in such a way that the blades rotates in clockwise direction. The clockwise rotation of turbine gives the positive side voltage readings. In X-axes direction of turbine column at 0^0 position, the turbine fan is kept above the column. When the bike engine starts, the gas blows out through silencer with pressure will fall on the air foil blades of turbine. The rotation of turbine fan should be in clockwise and power produces from the DC generator. The voltage reading is noted from the multimeter. The above process is repeated for other two times. The voltage readings are noted from multimeter for respective process repetition. The voltage readings are noted and also average of the three readings is also done and noted in the **table2** of appendix. In X-axes direction of turbine column at 90^0 position, the column is rotated at an angle 90^0 from the 0^0 position in anticlockwise direction. When the bike engine starts, the gas blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation should be in clockwise at effective place to record the optimum voltage reading from the multimeter occur through power generation in DC generator. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table2** of appendix. In X-axes direction of turbine column at 180^0 position, the column is rotated at an angle 90^0 from the 90^0 position in anticlockwise direction. In this position of turbine, the turbine fan is below to the turbine column. When the bike engine starts, the gas blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation should be in clockwise at effective place to record the optimum voltage reading from the multimeter occur through power generation in DC generator. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table2** of appendix. In X-axes direction of turbine column at 270^0 position, the column is rotated at an angle 90^0 from the 180^0 position in anticlockwise direction. When the bike engine starts, the gas blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation should be in clockwise at effective place to record the optimum voltage reading from the multimeter occur through power generation in DC generator. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table2** of appendix.

Y-axes: The turbine column is placed in y-axes direction and air foil blades of turbine are placed in front of the silencer outlet in such a way that the blades rotates in clockwise direction. The clockwise rotation of turbine gives the positive side voltage readings. In Y-axes direction of turbine column at 0^0 position, the column is at vertical direction and turbine fan is faced in front to the silencer outlet. When the bike engine starts, the gas blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation is not takes place at this position and no power generation in the DC generation. The voltage reading from the multimeter is zero because no rotation of turbine. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table2** of appendix. In Y-axes direction of turbine column at 90^0 position, the column is rotated at an angle 90^0 from the 0^0 position in anticlockwise direction. When the bike engine starts, the gas blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation should be in clockwise at effective place to record the optimum voltage reading from the multimeter occur through power generation in DC generator. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table2** of appendix. In Y-axes direction of turbine column at 180^0 position, the column is at vertical direction rotated an angle 90^0 from 90^0 position in anticlockwise direction and turbine fan is faced behind to the silencer outlet. When the bike engine starts, the gas blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation is not takes place at this position and no power generation in the DC generation. The voltage reading from the multimeter is zero because no rotation of turbine. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table2** of appendix. In Y-axes direction of turbine column at 270^0 position, the column is rotated at an angle 90^0 from the 180^0 position in anticlockwise direction. When the bike engine starts, the gas blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation should be in clockwise at effective place to record the optimum voltage reading from the multimeter occur through power generation in DC generator. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table2** of appendix.

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from the 90^0 position in anticlockwise direction. When the bike engine starts, the gas blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation should be in clockwise at effective place to record the optimum voltage reading from the multimeter occur through power generation in DC generator. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table2** of appendix. In Z-axes direction of turbine column at 270^0 position, the column is rotated at an angle 90^0 from the 180^0 position in anticlockwise direction. When When the bike engine starts, the gas blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation is not takes at this position and no power generation in the DC generator. The voltage reading from the multimeter is zero at this position because no turbine rotation. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table2** of appendix.

Bike setup at speed variation:A 150CC engine Bajaj Pulsar is considered for testing at effective direction and position of turbine. The effective direction and position of turbine is observed by comparing the optimum voltage readings from **table1** and **table2** of appendix of blower setup and bike setup at constant speed of air and gas i.e., noticed in X-axes direction at 180^0 position of turbine. The experiment on bike setup is done to determine the voltage readings at the speed variations in an open place, where surrounding air force presence. The presence of surrounding air force will leads to give the irregular rotation of wind turbine and gives voltage readings variation in multimeter. In bike setup, an IC engine is connected to silencer in order to blow the exhaust gases. The air foil blades of wind turbine are placed in front of silencer outlet. The turbine fan is connected to the rotor shaft of DC generator. The output of DC generator external winding is connected to the multimeter through probes. In X-axes direction of turbine column at 180^0 position, the turbine fan is below the turbine column. At this position, the turbine is at effective direction and effective position because the voltage readings are optimum in multimeter. When the bike engine starts and keeping the speed at 1000rpm, the gas blows out through silencer with a pressure fall on the air foil blades of turbine. The turbine rotation should be in clockwise direction at effective place to record the optimum voltage reading from the multimeter occurring through power generation in DC generator. The above process is repeated for other two times. The respective voltage readings are noted of process repetition and average of the three voltages is noted in the **table3** of appendix. Above process is repeated for 2000rpm, 3000rpm, 4000rpm and 5000rpm of bike engine speed at same direction and position. All voltage readings and average of voltage readings at different speeds are noted in **table3** of appendix. From **table3** of appendix, the maximum voltage reading generated at 5000rpm optimum economic speed of bike engine is 4.58 volts.

IV.RESULTS

Result: The project "**A Fabrication Model of Silencer Based Power Generation**" is fabricated such that turbine power generation from silencer air pressure and used the power for rural electrification. When the blower is switched on, the air blows out through silencer and fall on the turbine blades to rotate. The rotation of turbine will lead to power generation in the DC generator. The power generated in the DC generator of fabrication model setup is observed by LED light glowing, which is connected to DC generator as shown in **fig.8**.

Fig.8. LED glows with generated turbine power

The fabricated setup turbine power generated is used to charge the rechargeable battery as shown in the **fig.4.2**. In charging circuit of wood board, LED glows when the current in the charging circuit is 12 volts. The switch of bulb should be in off state when the turbine power is generated. After fully charged the rechargeable battery, bulb switch should be on.

Fig.9. Charging the battery by turbine power

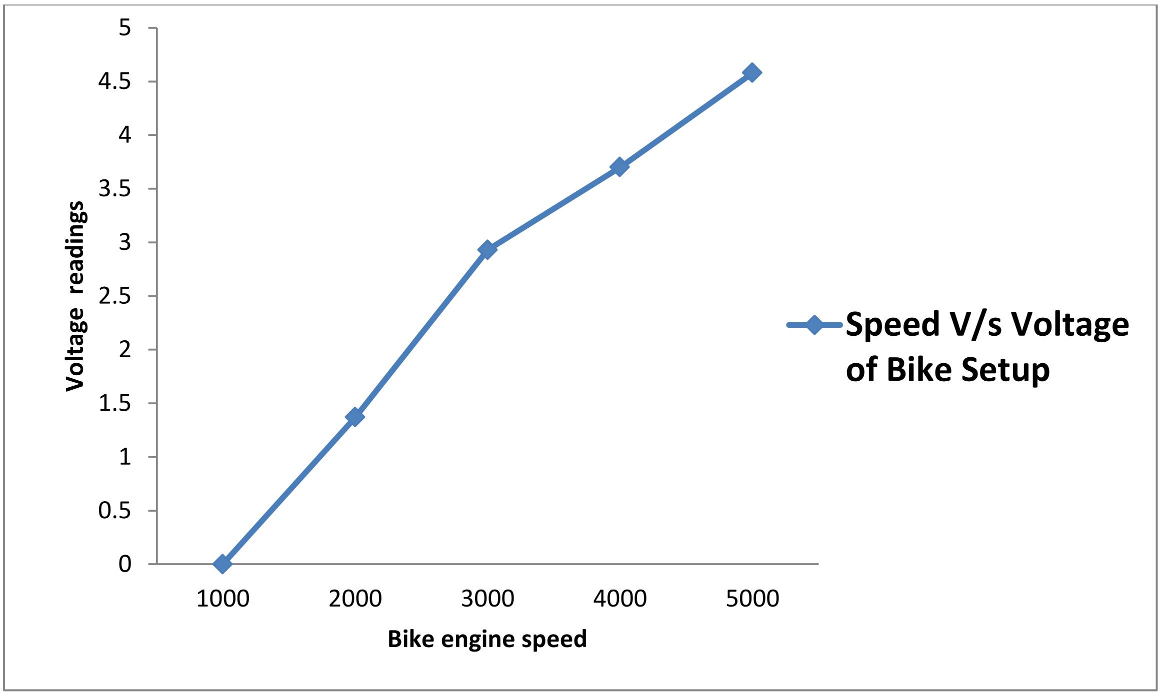
The voltage readings of blower setup experimented at 13000rpm speed first i.e., **table1** of appendix and later the voltage readings at 13000rpm blower speed are converted to 3000rpm blower speed by calculations i.e., **table4** of appendix. The blower setup and bike setup voltage readings at 3000rpm are noticed in **table4** and **table2** of appendix.The maximum and minimum voltage readings of each axes directions at respective positions of **table4** and **table2** of appendix in blower setup and bike setup at 3000rpm speed are noted as follows:

Blower Setup				Bike Setup			
Turbine Column Axes		Voltage Readings (volts)	Turbine Fan Position	Turbine Column Axes		Voltage Readings (volts)	Turbine Fan Position
X	Max.	1.59	180^0	X	Max.	2.45	180^0
	Min.	0.91	270^0		Min.	1.02	270^0
Y	Max.	1.16	270^0	Y	Max.	1.12	270^0
	Min.	0	$0^0/180^0$		Min.	0	$0^0/180^0$
Z	Max.	1.26	180^0	Z	Max.	1.50	180^0
	Min.	0	$90^0/270^0$		Min.	0	$90^0/270^0$

Table5. Voltage readings comparison of blower setup and bike setup

From above **table5**, it is noticed that the effective axes direction of turbine column is at X-axes and effective position of turbine fan is at 180^0 position in both blower setup and bike setup at 3000rpm speed, which generates more power in DC generator. So, the best axes and position of turbine to place in front of silencer outlet is X-axes at 180^0 position to do experiment of speed variation in bike setup. The voltage readings of speed variation in bike setup are noted in **table3** of appendix. The different speeds of bike engine are at 1000rpm, 2000rpm, 3000rpm, 4000rpm and 5000rpm.

From **table3**, a graph is drawn between the bike engine speed and voltage readings at respective bike engine speed. The bike engine speed in rpm is taken at X-axes and voltage readings in volts occurred at respective bike engine speed is taken at Y-axes. The voltage readings at respective bike engine speed are plotted on **graph1.** The **graph1** shows the approximately inclined linear incremental value of voltage readings with respect to engine speed. It means that the power generated in DC generator is more while increasing bike engine speed. But it is better to maintain the bike speed at economy in order to save fuel and also power generated in DC generator of turbine rotation in front of silencer outlet is stored in the rechargeable battery for future use or rural electrification. From **graph1** and **table3** of appendix, it is noticed that maximum power generated in DC generator at 5000rpm speed i.e., 4.58 volts.



Graph1. Bike engine speed V/s Voltage readings

Conclusions: Comparing the voltage readings at constant speed 3000rpm of **table4** and **table2** of appendix of blower setup and bike setup has small increment of voltage values in bike setup when compare to blower setup. The optimum voltage readings of blower setup and bike setup from **table4** and **table2** of appendix are observed that the effective direction and effective position of wind turbine of both setups are in X-axes direction of turbine column at 180^0 position of turbine fan rotation. At this position, the power generation in the DC generator is more compared to other directions and positions of turbine. In bike setup at speed variation of engine, the voltage readings from multimeter in effective X-axes direction of turbine column and effective 180^0 position of turbine fan are noted in **table3** of appendix. From **graph1**, it is shown that linearly inclined increment of voltage readings with respect to the different increasing bike engine speed. The maximum voltage reading generated at 5000rpm optimum economic speed of bike engine is 4.58 volts at effective X-axes direction of turbine column and effective 180^0 position of turbine fan rotation. Integrating features of all the used hardware components has been developed in it. Every module has been reasoned out and carefully placed and also contributed to the best working unit. With the help of growing technology, the highly advanced IC's are used in the project. The project has been successfully implemented and thus the project has been successfully fabricated and tested.

5. APPENDIX

Table1: Experimental voltage readings of blower setup at 13000rpm speed

Turbine column axes	Turbine fan position	Voltage readings (volts)			Voltage readings average
		1	2	3	
X	0^0	5.79	5.67	5.58	5.68
	90^0	5.21	5.12	5.16	5.18
	180^0	6.87	6.78	6.95	6.87
	270^0	4.02	3.93	3.87	3.94
Y	0^0	0	0	0	0
	90^0	3.23	3.09	3.16	3.16
	180^0	0	0	0	0
	270^0	5.02	4.98	5.13	5.04
Z	0^0	2.27	2.48	2.36	2.37
	90^0	0	0	0	0
	180^0	5.45	5.37	5.49	5.44
	270^0	0	0	0	0

Sample calculations:

At speed = 13000rpm;

Average voltage reading at Z-axes and 180^0 position = (5.45+5.37+5.49)/3 = 5.44 volts.

Table2: Experimental voltage readings of bike setup at 3000rpm speed

Turbine column axes	Turbine fan position	Voltage readings (volts)			Voltage readings average
		1	2	3	
X	0^0	2.21	2.05	2.40	2.22
	90^0	1.05	1.26	1.32	1.21
	180^0	2.31	2.56	2.48	2.45
	270^0	1.23	1.01	0.8	1.02
Y	0^0	0	0	0	0
	90^0	0.54	0.72	0.66	0.64
	180^0	0	0	0	0
	270^0	1.11	1.24	1.01	1.12
Z	0^0	0.42	0.33	0.61	0.45
	90^0	0	0	0	0
	180^0	1.53	1.72	1.26	1.50
	270^0	0	0	0	0

Sample calculations:

At speed = 3000rpm;

Average voltage reading at X-axes and 180^0 position = (2.31+2.56+2.48)/3 = 2.45 volts

Table3: Voltage readings at X-axes and 180^0 position of bike setup of speed variation

Speed (rpm)	Voltage readings (volts)			Average voltage reading
	1	2	3	
1000	0	0	0	0
2000	1.37	1.24	1.5	1.37
3000	2.67	2.84	3.27	2.93
4000	3.58	3.89	3.62	3.70
5000	4.52	4.38	4.83	4.58

Sample calculations:

At speed = 4000rpm;

Average voltage reading at 4000rpm speed = (3.58+3.89+3.62)/3 = 3.70 volts

Table4: Voltage readings of speed conversion from 13000rpm to 3000rpm of blower setup

Turbine column axes	Turbine fan position	Voltage readings (volts)			Voltage readings average
		1	2	3	
X	0^0	1.34	1.31	1.29	1.31
	90^0	1.20	1.18	1.19	1.19
	180^0	1.59	1.57	1.61	1.59
	270^0	0.93	0.91	0.89	0.91
Y	0^0	0	0	0	0
	90^0	0.75	0.71	0.73	0.73
	180^0	0	0	0	0
	270^0	1.16	1.15	1.18	1.16
Z	0^0	0.52	0.57	0.55	0.55
	90^0	0	0	0	0
	180^0	1.26	1.24	1.27	1.26
	270^0	0	0	0	0

Sample calculations:

1. Voltage reading conversion speed from 13000rpm to 3000rpm:

At X-axes direction and 0^0 position;

Voltage at speed 13000rpm (from **table1** of appendix) = 5.79 volts

Voltage reading at speed 3000rpm = (5.79 X 3000)/13000 = 1.34 volts

2. Average voltage reading at Y-axes and 270^0 position = (1.16+1.15+1.18)/3 = 1.16 volts

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