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Power Generation from Kinetic Energy of Exhaust Gases

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Abstract: - *Mankind has relied on fossil fuels for their energy needs for a long time. Reckless usage of these fuels has caused immense amounts of pollution and continued usage can lead to irreversible damage to the environment. In such circumstances, any step towards reducing the consumption of fuel or at the least making sure that most of the energy produced by burning these fuels is extracted without any wastage is a step in the right direction. This work proposes the usage of a miniature turbine at the silencer outlet to produce electricity. The results obtained in this work show that the technique used is suitable for implementation across all domestic vehicles for energy reclamation.*

I. INTRODUCTION

Over the last couple of decades, mankind has realized that the continuous usage of petroleum fuels to meet the worlds energy demand, over the course of more than a century, has led to innumerable consequences. An inclination towards other sources for energy has come into the forefront. Yet, we are still a long way from completely phasing out petroleum as an energy source altogether. In such a time, any progress towards reducing the amount of fuel consumed during energy generation is good progress and cannot be neglected. In recent years the scientific and public awareness on environmental and energy issues has brought in major interests to the research of advanced technologies particularly in highly efficient internal combustion engines. Viewing from the socioeconomic perspective, as the level of energy consumption is directly proportional to the economic development and total number of populations in a country, the growing rate of population in the world today indicates that the energy demand is likely to increase. Only 30 to 40% of total energy produced in an engine is utilized to run the vehicle and engine accessories.

The rest is wasted in the form of exhaust heat and noise. So, there is a scope for reclaiming the wasted power produced by the engine. Various methods to reduce the wastage of energy from automobile engines have been put forth. These include thermoelectric generators (TEG), Organic Rankin cycle (ORC), six-stroke cycle IC engine and new developments on turbocharger technology. Among many methods, turbine-based power generation through the exhaust gases has proven to be an efficient source of energy generation. Turbine Based Power Generation works on the principle of conversion of kinetic energy into electric energy. In this process, a turbine is fixed near the opening of the silencer. A dynamo is attached to the turbine, which converts kinetic energy generated through the turbine into useful electrical energy. This electric energy can be further utilized in a stored form with the help of a battery or can be utilized to run an electrical accessory on the vehicle [1].

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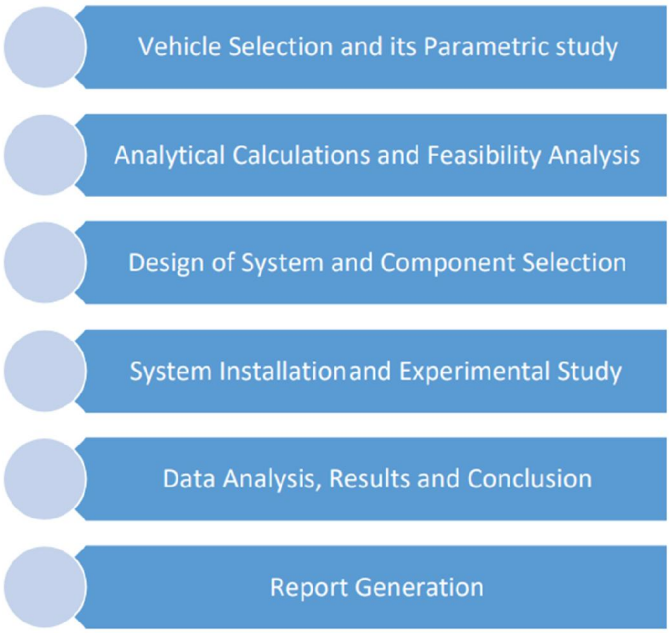
II. Proposed Plan of Work



III. Methodology

In this project a two-wheeler will be selected based on availability and system installation feasibility. A through literature review will be done on this topic and the observations made by different authors will be studied for its implementation and its scope of improvement. Further based on the review parametric study of the vehicle will be performed which includes studying the exhaust gas parameters, exhaust design etc. Based on the parameters analytical calculations will be performed for system design. According to the calculations and market survey different components required will be selected and procured. Utilizing the procured components, the system is assembled on the vehicle and experimental analysis is done.

After experimentation, data analysis of the generated data is performed and is studied for system improvement and efficiency. Further results and conclusions will be generated with report generation. Power is generated by using automobile exhaust gas is very simple and easy non-conventional process. Energy generation using vehicle silencer needs no fuel input power to generate the output of the electrical power. This project using simple mechanism same as wind energy power generation. For this project the main Working Principle is Conversion of the forced kinetic energy into electrical energy. In this the exhaust gases released from the automobile Silencer is used to rotate the turbine (fan blades) by arranging it is very conveniently. The nozzle is attached to the silencer is used to proper flow of exhaust gases with high velocity and steady flow with uniform direction to rotate the turbine. The dynamo attached to the turbine with shaft is used to convert the forced kinetic energy (K.E) into electrical energy (E.E) is by rotating dynamo. Power Generation Using Exhaust Gases‖ is mainly intended to design a silencer-based energy generation system-based inverter. Air blowers generally use centrifugal force to propel air forward.

The following components were required to implement the work proposed.[2]

3.1 Turbine:

A turbine is a rotary mechanical device that extracts energy from a fluid flow and converts it into useful work. The work produced by a turbine can be used for generating electrical power when combined with a generator. The mounting is to be done in such that as the vehicle moves, the exhaust gases produced will rotate the turbine blades, which will be used to generate power from a dynamo.[3]

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Figure 1: Turbine

3.2 Dynamo:

Dynamo is an electrical generator. This dynamo produces direct current with the use of a commutator. Dynamos were the first generator capable of the power industries. The dynamo uses rotating coils of wire and magnetic fields to convert mechanical rotation into a pulsing direct electric current. A dynamo machine consists of a stationary structure, called the stator, which provides a constant magnetic field, and a set of rotating windings called the armature which turn within that field. On small machines the constant magnetic field may be provided by one or more permanent magnets; larger machines have the constant magnetic field provided by one or more electromagnets, which are usually called field coils. The dynamo used for this analysis is RS-775, which has a maximum output voltage of 12 V [4].

Figure 2: Dynamo

IV. Related Works

Kranti Kumar Guduru et al. [1] studied that electrical energy can be obtained by utilizing the kinetic energy of the exhaust gases. They made use of a turbine, dynamo, battery and nozzle for this purpose. After carrying out the experiments they found that the voltage produced at the output is directly proportional to the exhaust velocity. They also found that the efficiency increases with increase in velocity. Shrikant Gawas et al. [2] worked on a turbocharger system and found that the emission rate can be controlled by using exhaust energy recovery and by providing proper compressed air into the inlet of the cylinder.

They used a turbocharger, a thermal activator device and a dynamo to achieve it. By carrying out the study they found that the efficiency of the engine can be significantly increased by this method. Shaikh Mobin et al. [3] stated that electric energy can be produced by utilizing the exhaust gas of an automobile. They made use of a turbine, gears and a DC generator to conduct their experiments. From the experiments they found that the power generated is directly proportional to the speed of the turbine. Venkatesh et.al [4] generated electricity from hot exhaust gases using turbine and dynamo and found their system to be cost effective and efficient.[5]

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V. CONCLUSION

From the study, it has been identified that there are large potentials of energy savings through the use of waste heat recovery technologies. Waste heat recovery entails capturing and reusing the waste heat from internal combustion engine and using it for heating or generating mechanical or electrical work. It would also help to recognize the improvement in performance and emissions of the engine if these technologies were adopted by the automotive manufacturers. The study also identified the potentials of the technologies when incorporated with other devices to maximize potential energy efficiency of the vehicles. The project carried out by us made an impressing task in the field of mechanical department. It is used for to produce the current in vehicle exhaust unit.

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