FABRICATION OF TURBOCHARGER FOR TWO WHEELER

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ABSTRACT
Turbocharger is a device that increases the overall performance of engine by reusing the exhaust heat to drive the turbine. A two wheeler engine with turbocharger increases the power of engine and with reusing of exhaust gas which results of less fuel consumption. The immediate objective of this report project is to develop and upgrade two wheeler for commercial purpose as well as racing purpose. The emphasis today is to provide feasible engineering solution to manufacturing economics and “greener” road vehicle. It is because of this reason that turbocharger are now becoming more popular in automobile applications.

KEYWORDS: Turbocharger, IC Engine, Volumetric Efficiency.

INTRODUCTION
A turbocharger or turbo is a forced induction device used to allow more power to be produced for an engine of a given size. The key difference between a turbocharger and a conventional supercharger is that the latter is mechanically driven from the engine often from a belt connected to the crankshaft, whereas a turbocharger is driven by the engine's exhaust gas turbine.

A turbocharged engine can be more powerful and efficient than a naturally aspirated engine because the turbine forces more intake air, proportionately more fuel, into the combustion chamber than if atmospheric pressure alone is used. Turbos are commonly used on truck, car, train and construction equipment engines. Turbos are popularly used with otto cycle and diesel cycle internal combustion engines.

TURBO CHARGER
Turbo-charging, simply, is a method of increasing the output of the engine without increasing its size. The basic principle was simple and was already being used in big diesel engines. European car makers installed small turbines turned by the exhaust gases of the same engine. This turbine compressed the air that went on to the combustion chamber, thus ensuring a bigger explosion and an incremental boost in power.
Intercoolers the latest turbos they are used by most of today’s turbo-diesel engines to make the compressed air denser. It works like this - on starting, exhaust gases spin the turbine and thus activate a compressor that pressurizes the air.

This pressurized air from the turbocharger is then sent through a duct to an air-cooled intercooler, which lowers the temperature of the intake charge and thus increases its density. The air-cooled intercoolers receive air through separate intakes and that explains the small scoops and louvers usually found on the hoods of turbo-charged cars.

Modern turbo-diesel engines also make use of a temperature-sensitive, motor-driven fan which boosts airflow at low engine speeds or when the intake air temperature is high.

Figure-1 Turbocharger in Two Wheeler

MOTORCYCLE TURBOCHARGER
Motorcycle Turbo Charger using turbochargers to gain performance without a large gain in weight was very appealing to the Japanese factories in the 1980s.

The first example of a turbocharged bike is the 1978 Kawasaki Z1R TC. It used a Ray jay ATP turbo kit to build 0.35 bar (5 lb) of boost, bringing power up from 90 hp (67 kW) to 105 hp (78 kW). However, it was only marginally faster than the standard model. In 1982, Honda released the CX500T featuring a carefully developed turbo (as opposed to the Z1-R’ s bolt-on approach). It has a rotation speed of 200,000 rpm. The development of the CX500T was riddled with problems; due to being a V-twin engine the intake periods in the engine rotation are staggered leading to periods of high intake and long periods of no intake at all.

LITERATURE REVIEW
FABRICATION AND PERFORMANCE TEST OF TURBOCHARGER FOR TWO WHEELER
BY: B Jnana Deepak, N Krishna Priya, B Revanth, K S Jaya Prakash, and B Hemanth Kumar
In present situation, everybody in this world needs to ride a high powered, high fuel efficient and less emission two wheelers. In order to meet the requirements of the people an attempt have been made this in this project to increase the power by using the exhaust gas of the engine by passing this gas on to turbine compressor arrangement. This compressor compresses the fresh air and is sent to the carburettor. The authors have mainly aimed to increase the air: fuel ratio therefore all the requirements were fulfilled by this process.
TURBOCHARGING OF TWO STROKE S.I. ENGINE
Effect, design and installation of turbo charger s.i. engine are available in this paper. Turbo charger in two wheeler which increase efficiency of engine. Supercharger works on engine power while turbo charger works on exhaust gases. We aim to increase to volumetric efficiency of Honda shine bike of 125cc and also emission from engine can be control. Small modification is done on vehicle to improve efficiency and control emission.

PERFORMANCE ANALYSIS AND FABRICATION ON A TURBOCHARGER IN TWO STROKE SINGLE CYLINDER PETROL ENGINE
BY: Mohammad Isra, Amit Tiwari, Mahendra Labana, Anshul Gangele
Turbo chargers are used throughout the automotive industry as they can enhance the output of an internal combustion (IC) engine without the need to increase its cylinder capacity. The emphasis today is to provide a feasible engineering solution to manufacturing economics and “greener” road vehicles. It is because of these reasons that turbochargers are now becoming more and more popular in automobile applications. The new turbocharger is coupled to an air-water intercooling system to decrease the inlet air temperatures. This project analysed the intercooling system and tested the final design in the vehicle. The results show that the cooling system components purchased are adequate for this system. The aim of this paper is to provide a view on the techniques used in turbocharging used in two stroke single cylinder petrol engine by this to increase the engine output and reduce the exhaust emission levels. This paper is to analyse a turbocharger system in a two stroke petrol engine. The ideal turbocharger design would be smaller than the system purchased. The paper will also create speed sheets for use in calculating the necessary parameters for another turbocharger system, or to modify the current system.

TURBOCHARGING OF IC ENGINE
BY: Mohd Muqeem and Dr. Manoj Kumar
Turbo chargers are used throughout the automotive industry as they can enhance the output of an internal combustion (IC) engine without the need to increase its cylinder capacity. The application of such a mechanical device enables automotive manufacturers to adopt smaller displacement engines, commonly known as “engine downsizing”. Historically, turbo chargers were often used to increase the potential of an already powerful IC engine. The emphasis today is to provide a feasible engineering solution to manufacturing economics and “greener” road vehicles. It is because of these reasons that turbochargers are now becoming more and more popular in automobile applications. The aim of this paper is to provide a review on the techniques used in turbocharging to increase the engine output and reduce the exhaust emission levels.

MODIFICATION AND ANALYSIS OF 125cc PETROL ENGINE WITH TURBOCHARGER
BY: Sujith G, Jishnu S Nair, Mohammed Jezry Faruq, Muhammad Ameer M, Nithin P Nair
Due to the increase of motorcycles, petrol consumption and emission rate increases day by day. An attempt has been made in this project to use the exhaust gas to rotate a turbine thereby rotating a compressor for supplying compressed air to inlet. A turbocharger increases the pressure at the point where air enters the cylinder, thereby increasing the pressure gradient across the intake valves and thus more air enters the combustion chamber. It allows proper combustion of fuel and increases the efficiency of engine. A turbocharged engine can be more powerful and efficient than a naturally aspirated engine because of the increase in the quantity of intake air into the combustion chamber than if atmospheric pressure alone is used. In this project we used a 125cc engine for our analysis. In our work the turbocharger is mounted in front of the engine near the exhaust ports in order to minimize heat losses and improve turbo response. Front mounting of the turbocharger isolates the heat from the rider, removes the turbocharger from its conventional location behind the engine where it can get hot enough to boil the fuel in the fuel tank.

FABRICATION AND IMPLEMENTATION OF TURBOCHARGER ON TWO STROKE VEHICLE
BY: Yogesh Gaikwad, Rohit Jadhav, Abhishek Shinde, Pradeep Mane, Sager Patil
In present situation everybody in this world needs to ride a high powered, high fuel efficient and less emission two wheelers. In order to meet the requirements of the people an attempt have been made this in this project to increase the power by using the exhaust gas of the engine by passing this gas on to turbine compressor arrangement. This compressor compresses the fresh air and is sent to the carburettor. Now a day the demand of the fuel is increased because of turbocharger is important to increase the performance and the fuel efficiency is increased by using turbocharger.

ANALYSIS OF SUPERCHARGER AND TURBOCHARGER USING ETHANOL GASOLINE BLEND
BY: Vidit Saxena, Shivpratap Singh Hada and Sourabh Jain
There are many inventions aimed at incrementing the performance of IC engines. In general, practical engines are always compromised by trade-offs between different properties such as efficiency, weight, puissance, heat, replication, exhaust emissions, or noise. When power increases efficiency is always decreases. Presently, ethanol is prospective material for use in automobiles as an alternative to petroleum predicated fuels. The main reason for advocating ethanol is that it can be manufactured from natural products or waste materials, compared with gasoline, which is engendered from non-renewable natural resources. Some methods and components are utilisable for incrementing performance of engine. One such method is the utilization of supercharger in I.C. Engine. It is kenned that the puissance outputs of an engine increases with the instrumentation in amount of air or coalescence in the cylinder and supercharger plays a paramount role in incrementing the amount or air. Till now supercharger is being prosperously employed in cumbersomely hefty engines but its use with more minute engine is still under development.
PERFORMANCE ANALYSIS OF IC ENGINE USING SUPERCHARGER AND TURBOCHARGER
BY: Prashant. N. Pakale, S. U. Patel

There are many inventions aimed at increasing the performance of IC engines. So most engines nowadays are employed with turbocharger and supercharger. It is known that the power outputs of an engine increases with the increase in amount of air or mixture in the cylinder and supercharger plays an important role in increasing the amount or air. Turbochargers are used throughout the automotive industry as they can enhance the output of an internal combustion (IC) engine without the need to increase its cylinder capacity. The emphasis today is to provide a feasible engineering solution to manufacturing economics and “Greener” road vehicles. It is because of these reasons that superchargers and turbochargers are now becoming more and more popular in automobile applications. The aim of this paper is to provide a review on the techniques used in supercharging and turbocharging to increase the engine output and reduce the exhaust emission levels.

WORKING PRINCIPLE
A turbocharger is a small radial fan pump driven by the energy of the exhaust gases of an engine. A turbocharger consists of a turbine and a compressor on a shared shaft. The turbine converts heat to rotational force, which is in turn used to drive the compressor. The compressor draws in ambient air and pumps it in to the intake manifold at increased pressure, resulting in a greater mass of air entering the cylinders on each intake stroke.

MAIN COMPONENTS
There are four main components are following.

a) TURBINE
Energy provided for the turbine work is converted from the enthalpy and kinetic energy of the gas. The size and shape can dictate some performance characteristics of the overall turbocharger. Often the same basic turbocharger assembly is available from the manufacturer with multiple housing choices for the turbine, and sometimes the compressor cover as well.
This lets the balance between performance, response, and efficiency be tailored to the application. It uses the heat and pressure of the exhaust gas to rotate the compressor. In short it is used to give drive to the compressor with the help of pressure of the exhaust gas which rotates the turbine.

b) COMPRESSOR
It is driven by the turbine. It inhales the air from the atmosphere and compresses it at high pressure for the next suction stroke. The compressor increases the mass of intake air entering the combustion chamber. The compressor is made up of an impeller, a diffuser and volute housing. The operating range of a compressor is described by the "compressor map".

c) CENTRE HOUSING/ HUB ROTATING ASSEMBLY
The centre hub rotating assembly (CHRA) houses the shaft that connects the compressor impeller and turbine. It also contains oil lines for lubrication of bearings and maintaining the temperature of this system. The centre hub rotating assembly (CHRA) houses the shaft that connects the compressor impeller and turbine. It also must contain a bearing system to suspend the shaft, allowing it to rotate at very high speed with minimal friction.

d) INTERCOOLER
When the pressure of the engine's intake air is increased, its temperature also increases. In addition, heat soak from the hot exhaust gases spinning the turbine will also heat the intake air. The warmer the intake air, the less dense, and the less oxygen available for the combustion event, which reduces volumetric efficiency. Not only does excessive intake-air temperature reduce efficiency, it also leads to engine knock, or detonation which is destructive to engines. Turbocharger units often make use of an intercooler to cool down the intake air. Intercoolers are often tested for leaks during routine servicing, particularly in trucks where a leaking intercooler can result in a 20% reduction in fuel economy.

CALCULATION
Engine specification: Suzuki slingshot plus disc
Displacement: 124cc
Maximum power: 27BPH
Maximum torque: 10Nm 3500 rpm
Gear box: 6 speed
Exhaust gas temperature: -700 degree Celsius
Exhaust gas pressure: 3.2bar (expected)

FABRICATION
AIM: To take the reading of pressure and temperature of the exhaust of engine and comparison of the engine performance with or without turbocharger.
EXPERIMENT SETUP

1. Setup a rope brake dynamometer
2. Setup stand for the rope brake dynamometer
3. The pulley with rope is attached to the stand by the spring.
4. The engine is attached to the pulley by the shaft.
5. The carburettor and silencer is fixed to the engine and the engine is started.
6. The reading of exhaust temperature and pressure is taken when turbocharger is not connected and its efficiency is calculated and measured.
7. The turbocharger is connected to the silencer of the engine and then the readings should be taken and again the efficiency is calculated and measured.
8. The exhaust pressure and temperature of the engine is taken down.
9. The comparison between the reading of engine taken with or without the turbocharger connected to the engine.

EFFICIENCY RESULT

The characteristic curve for Suzuki engine with and without turbo-charger (Improving efficiency) is shown in Figure. During full throttling about found emitting HC not within the prescribed national standard of 2000 PPM. The low percentage of scooters emitting hydrocarbon in the said range might be attributed to the fact that all scooters tested were having two stroke engines while a few models of motor bikes had four strokes engine as well which do not require pre-mixing of mobile oil in petrol as lubricant.

![Figure-3 GRAPH: Comparison of Time Vs RPM](image)

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