

Multi-Fuel Gas-Operated Low Displacement Automotive Spark Ignition Engine

1. Technology:

To ensure unrestricted transportation flow, it is high time to develop engines fuelled with multiple gaseous fuels to perform superior performance, lower fuel consumption and lower exhaust emissions. The objective of the invention is to convert low displacement (displacement volume less than 1000 cc) naturally aspirated (BS-IV) engines to turbocharged engines (BS-VI) at low cost. The multi-fuel engines available in the market are tuned for only one particular fuel. The engine parameters which influence performance and emission like compression ratio, ignition timing, combustion chamber geometry and electronic control unit are optimized for one fuel only. This leaves ample room for the development of a better level of fuel energy use for multi-fuel operations. To achieve so, such an engine must count on a variable volumetric compression ratio, which, despite being technically possible, is not economically viable for a low-cost product. To address the gap, the project intends to create a system capable of achieving the best performance for various gaseous fuels through a turbocharger by varying the boost pressure, which is viable for a low-cost product without changing its piston to alter the compression ratio. Also, the spark timing (minimum advance for best torque-MBT) for each of the fuel is different and for best performance figures the engine needs to be mapped for different running conditions using laboratory tests. The mapping results should be incorporated to operate the engine using an advanced engine controller. Overall, modifying the naturally aspirated engine can be an effective way to operate the engine at a lower compression ratio in turbocharged mode, resulting in reduced thermal loading on the engine. Also, It is possible to operate the engine at different compression ratios using different gaseous fuels without changing the piston with increased power output, reduced fuel consumption and reduced emissions only by changing the boost pressure through the turbocharger.

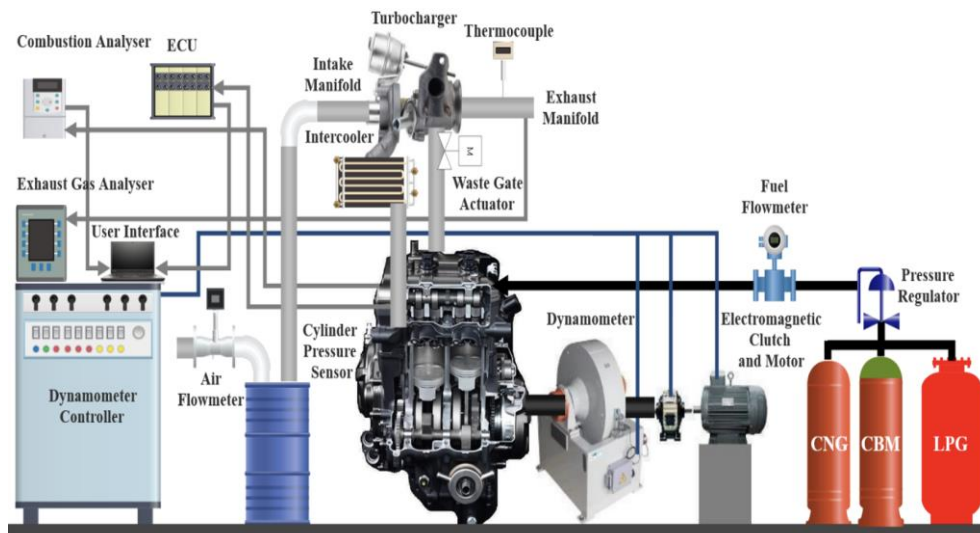


Fig. 1 Experimental Layout

2. Problem Addressed:

The impact of climate change due to fossil fuel usage led automotive industries to rely on gaseous fuels and auxiliary engine technologies, which can reduce emissions and increase fuel efficiency. The development of new generation low displacement automotive spark ignition engines necessitates the use of different types of fuel. Among them, Compressed Natural Gas (CNG), Hydrogen (H₂), Compressed Biomethane (CBM) and Liquefied Petroleum Gas (LPG) are promising alternate gaseous fuels. The infrastructure for the distribution of these fuels is geographically restricted to particular regions. Hence, to ensure unrestricted transportation flow, it is high time to develop engines fuelled with multiple gaseous fuels to perform superior performance, lower fuel consumption and lower exhaust emissions.

3. Industrial Applications:

The present invention involves converting low-displacement automotive naturally aspirated engines to turbocharged engines. The developed multi-fuel engine technology will be used in the automotive industry.

4. Patent Application Number: 202441085843