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"FABRICATION OF COMPRESSED AIR VEHICLE SYSTEM"

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ABSTRACT

This study aims to design and determine the performance of pressurized air-powered cars. The design results in the form of a four-wheeled air-powered car with a capacity of one person, the engine uses a four vanes-reversible air motor with a maximum rotation of 3000 rpm equipped with an air tube capacity of 6 m3 of pressure 150 bar. Test results with an operating pressure of 80 psi produce 2.74 HP. The car can drive stably and without significant obstacles. An air-powered car with light construction, simple way of working, low manufacturing and maintenance costs, does not produce exhaust emissions. However, it also has a disadvantage that there is still a rather noisy sound from the air outlet; it still needs a large enough and strong tube size to accommodate high pressure air and large capacity. If these weaknesses can be overcome, pressurized air-powered vehicles will become one of the cars of the future.

Key Words: *Air, Compressor , Car, Pressure*

I. INTRODUCTION

Cars with compressed air drives are not as popular as compared to gasoline cars, diesel cars, or even electric cars. But who would have thought the engine technology by using compressed air has existed since the end of the 19th century. In 1872 the Mekarski air engine was used for street transit, which consisted of a single-stage engine [1,2]. Charles B Hodges will always be remembered as the true father of the pioneering application of the concept of a powered air - car. He not only succeeded in creating a pressurized air drive car but also successfully commercialized a vehicle using a pressurized air drive engine [1,2]. After twelve years of research and development, Guy Negre managed to develop a machine that could become one of the most significant technological leaps of the century. A French mechanical engineer has professionally managed to design engines that are fuel-efficient and without air pollution for city vehicles using compressed air technology [1]. "Air Car" from Motor Development International has significantly stepped up to create a zero-emission car, using a pressurized air drive engine that is safe, quiet, and has a maximum speed of 110 km/hour with a roaming capability of up to 200 km. Guy Negre is the head of research and development at Motor Development International (MDI) Car, which in 1994 successfully created the prototype Zero Emission Vehicle (ZEV) [1]. Vehicles drove off on the highway are still dominated by gasoline and diesel-fueled vehicles.

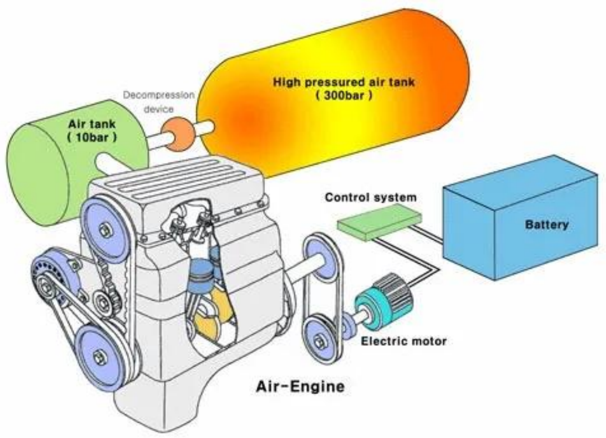

Figure.1 Air Compressed system

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Air pollution in urban areas, approximately 70%, is caused by vehicle emissions [3]. On the other hand, fossil fuel reserves around the world are running out so that oil-fueled vehicles will not be sustainable. Various attempts have been made to overcome the condition, including developing fuel efficient cars, electric cars, developing vegetable oil fuels, hybrid vehicles, and many more. The development of fuel-efficient cars cannot provide a long-term solution because it still uses fossil fuels that will eventually run out. While electric cars have advantages, among others: relatively more economical, zero pollution, noiseless, and energy sources can be obtained from renewable energy. But electric cars also have weaknesses in battery charging technology which still need a time to recharge the power. In this study, pressurized air drive cars were developed using a machine in the form of a four vanes reversible water motor.

II. Literature Review

The increasing concern over environmental pollution and fossil fuel depletion has motivated researchers to explore alternative vehicle propulsion systems. Among these, compressed air technology has emerged as a promising solution for clean and sustainable transportation.

Srinivasa Chari et al. (2015) developed an automatic pneumatic bumper and brake actuation system that improved vehicle safety by utilizing compressed air to reduce collision impact. Their research demonstrated that pneumatic systems could offer fast response and reliable operation compared to mechanical systems.

Dr. P. Poongodi and Mr. P. Dinesh Kumar (2015) studied automatic safety systems for automobiles using pneumatic mechanisms. They concluded that such systems provide better control, lower maintenance, and higher safety performance during emergencies.

Jadhav N. D. et al. (2015) proposed an automatic braking system with a pneumatic bumper, showing that compressed air can effectively be used in lightweight vehicles for both braking and impact absorption. Their work reinforced the potential of air pressure-based energy conversion for small vehicle applications.

Dr. Eung Soo Kim (2014) designed an auto braking system using sensors integrated with pneumatic actuators. His study revealed that the combination of sensors and compressed air improved accuracy, response speed, and braking stability.

Takahiro Wada (2013) introduced a deceleration control method for collision avoidance based on driver perceptual risk, suggesting that integrating intelligent control with pneumatic systems could significantly enhance vehicle safety and automation.

From the reviewed literature, it is evident that compressed air systems can play a key role in developing future automotive technologies. They are simple in design, cost-effective, and environmentally friendly. Building on these research efforts, the present project focuses on designing an air-powered car that operates without fuel combustion, achieving zero emissions and reduced operating cost while offering a sustainable alternative to conventional vehicles.

III. Methodology

Pneumatic braking system of an intelligent electronically controlled automotive braking system. Based on this model, control strategies such as an 'antilock braking system' (ABS) and improved maneuverability via individual wheel braking are to be developed and evaluated. There have been considerable advances in modern vehicle braking systems in recent years. For example, electronically controlled ABS for emergency braking, electronically controlled hydraulically actuated individual brake-by ultrasonic (BBW) systems for saloon cars and electronically controlled pneumatically actuated systems for heavy goods vehicles. The work of recent years shall form the basis of a system design approach to be implemented. The novelty of the proposed research programmed shall lie in the design and evaluation of control systems for achieving individual wheel motion control facilitated by BBW. In the case of BBW the brake pedal is detached from the hydraulic system and replaced by a 'brake pedal simulator'. The simulator provides an electrical signal for the electronic control system.

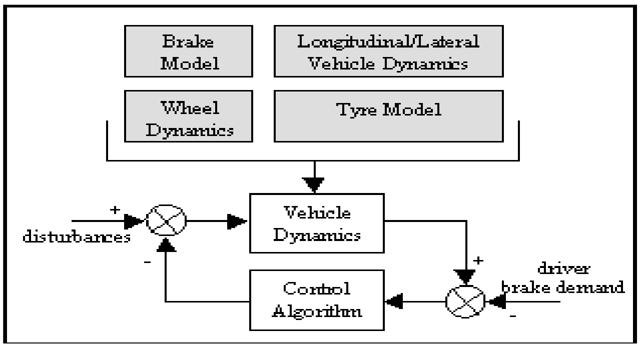

Figure 2 Vehicle Dynamics Components

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IV. EXPERIMENTAL SETUP

The prototype consists of a lightweight three-wheeled frame powered by a four-vane reversible air motor. A compressed air tank with a capacity of 6 m³ and pressure of up to 150 bar was used as the energy source. The system included a 12V DC compressor, 5/2 pneumatic valve, relay control unit, and ATmega 328 microcontroller to manage air flow and switching operations. The control system was integrated with an LCD display to monitor the system status during operation. Recent studies have further strengthened the development of compressed air vehicles and pneumatic braking technologies. R. Senthil Kumar et al. (2016) designed a compressed air engine for lightweight transportation systems and demonstrated that pneumatic propulsion can significantly reduce fuel dependency and environmental pollution. Their study emphasized the importance of efficient air storage and pressure regulation for improving vehicle performance.

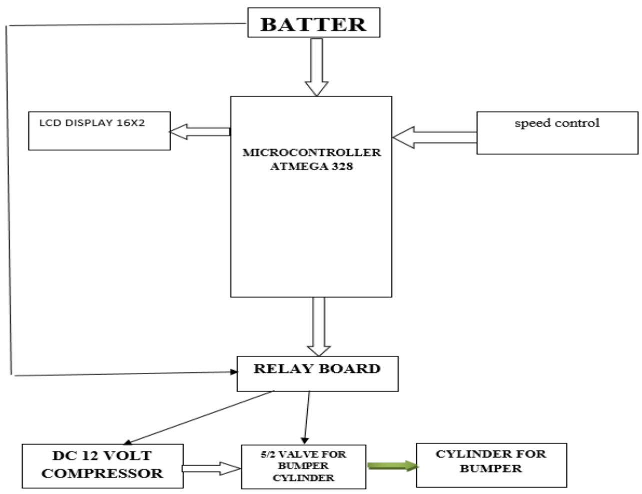

Figure.3 Block Diagram and Working of System

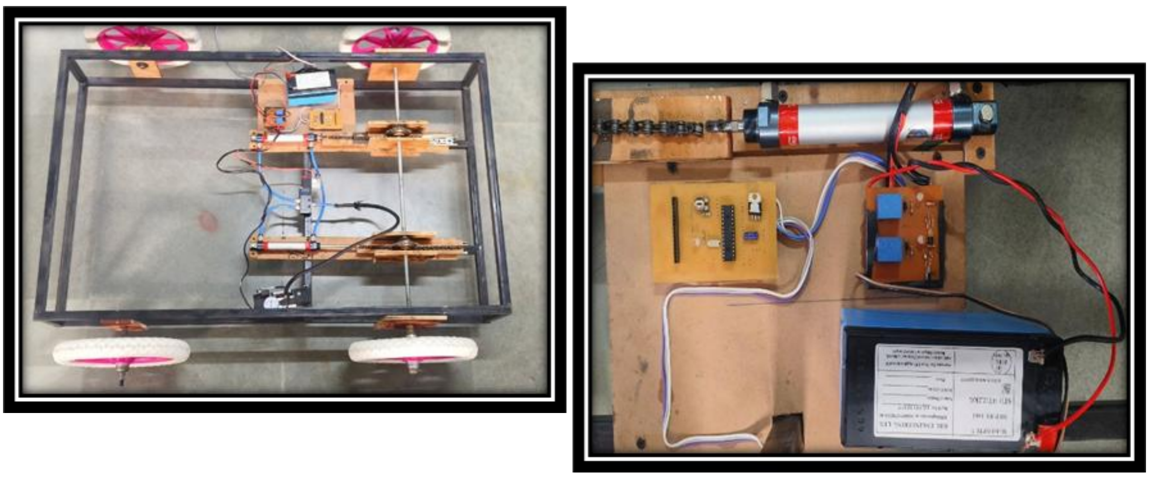

Figure 4 (a) & (b) Actual setup with different view

V. RESULT ANALYSIS

The analysis indicated that higher air pressure directly increases motor torque and vehicle speed but also results in faster air consumption. The system performed efficiently at 80–100 psi, providing an optimal balance between speed and pressure utilization. The results confirm that compressed air can effectively power lightweight vehicles with

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minimal maintenance and zero pollution.

Variation of Power with Pressure

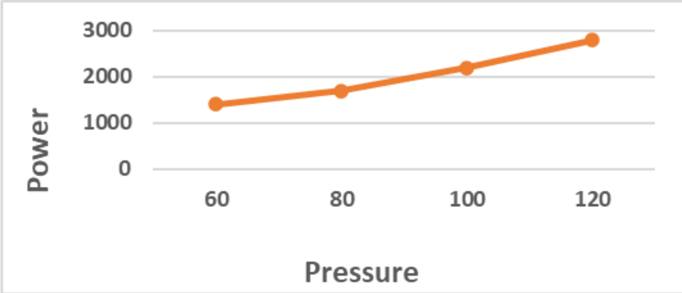

Figure 3 Variation of Power with Pressure

Variation of Speed with Pressure

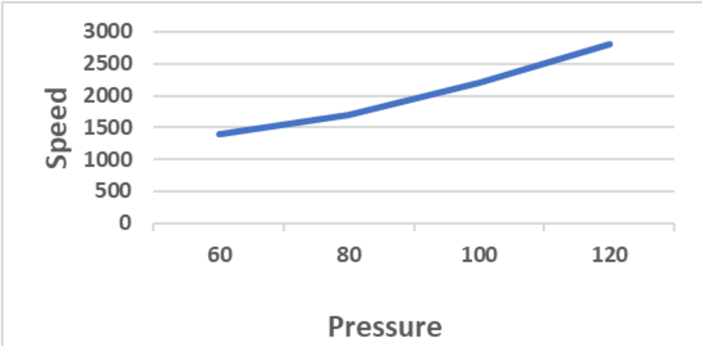

Figure 4 Variation of Speed with Pressure

Variation of Torque with Pressure

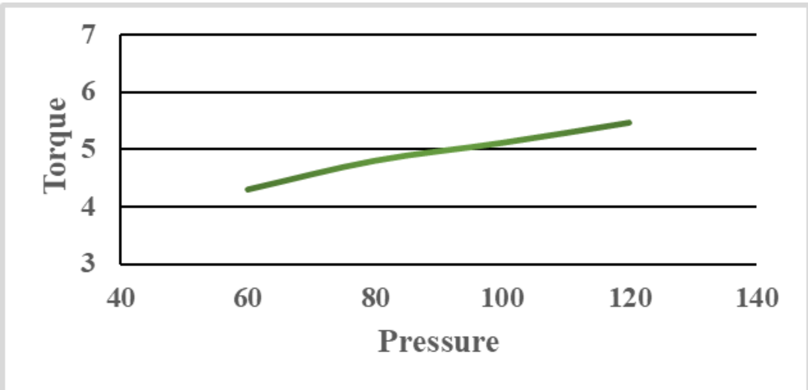

Figure 5 Variation of Torque with Pressure

VI. Conclusion

The conclusion explains that air-powered cars are a simple, economical, and environmentally friendly alternative to conventional fuel-powered vehicles. These cars operate using compressed air instead of petrol or diesel, which makes their construction lightweight and less complex. Because they use fewer mechanical components, the manufacturing and maintenance costs are lower compared to traditional automobiles. Another important advantage is that air-powered cars do not produce harmful exhaust emissions, as no fuel is burned during operation. This helps reduce air pollution

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and supports environmental protection.

However, the conclusion also highlights certain disadvantages of air-powered vehicles. One major issue is the noise produced when compressed air is released through the air outlet. In addition, strong and durable tanks and pipes are required to store high-pressure air safely. The technology also needs proper infrastructure, such as high-pressure air filling stations of around 100 bar, for large-scale use.

Despite these limitations, air-powered cars have strong future potential. If the problems related to noise, storage, and infrastructure are solved, these vehicles could become an efficient, low-cost, and sustainable transportation option for the future.

Future Scope

The compressed air vehicle is suitable for eco-friendly and zero-emission transportation, especially for short-distance travel in campuses,
industrial plants, airports, and townships. It can also be used in hazardous environments where fuel-based vehicles are unsafe, as well as for educational and research purposes in pneumatics and alternative energy systems.

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