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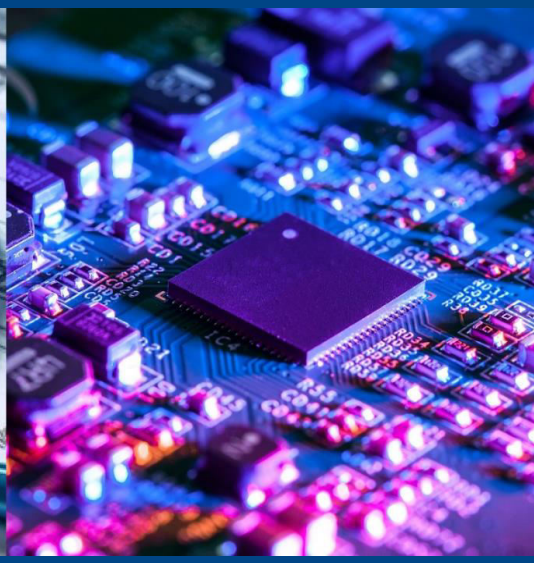

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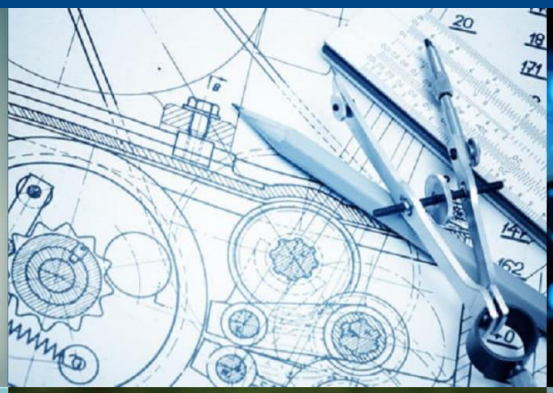

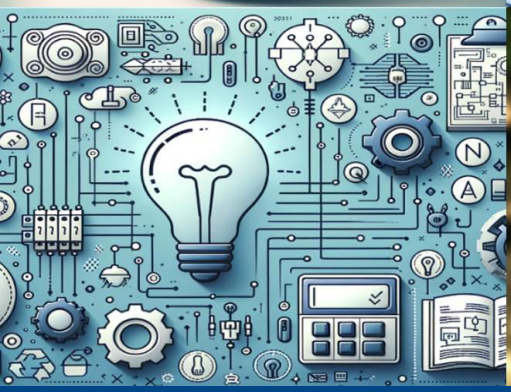

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Demo Model of Air Operated Vehicle

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ABSTRACT: This project focuses on the design and development of a pneumatic vehicle that utilizes compressed air as a primary source of power for motion. The system incorporates two pneumatic cylinders (150mm stroke length, 16mm bore diameter) to generate linear motion, which is then converted into rotational motion using a chain and sprocket mechanism with a freewheel system, allowing unidirectional movement. A10- liter compressed air cylinder serves as the energy storage unit, while a 5x2 single solenoid direction control valve regulates airflow into the cylinders. For remote operation, the vehicle is equipped with an Arduino UNO and an HC-05 Bluetooth module, enabling wireless control. The entire setup is mounted on a 20mm x20mm square MS pipe frame (755mm x 490mm) and runs on four wheels of 100mm diameter. This project aims to explore the feasibility of air- powered vehicles, emphasizing efficiency, sustainability, and alternative energy sources for transportation. The pneumatic vehicle serves asa prototype for environmentally friendly transportation and automation applications, demonstrating the potential of compressed air as an alternative energy source. The system's design and control mechanism contribute to advancements in pneumatic mobility solutions, making it a valuable study in mechanical automation and energy-efficient vehicle design.

I. INTRODUCTION

A pneumatic vehicle is a vehicle that uses compressed air as its power source for motion, rather than traditional fuels like gasoline or electricity. These vehicles are part of the growing interest in sustainable transport solutions. Pneumatic systems rely on air pressure to drive pistons or turbines, converting potential energy stored in compressed air into mechanical work to propel the vehicle. These vehicles are considered environmentally friendly as they produce no direct emissions, relying on the principle so fair compression and release. 1.1 HISTORYOFPNEUMATICVEHICLEA Early Concepts (18th-19thCentury)

- 18th Century (Pre-Industrial Revolution): Early ideas of using compressed air for propulsion were mostly theoretical, with rudimentary experiment sand discussions around the concept of air-driven engines.
- Late 19th Century: With the advent of the Industrial Revolution, ideas about using air as a source of energy became more practical. Pneumatic power was explored in various forms, including air-powered engines for trains and streetcars. B Early Air-Powered Vehicles (Late 19th Century)
- 1872 - French Engineer Gustave Trouvé: built one of the first air-powered vehicles. His invention utilized compressed air to drive a small vehicle, showcasing the possibility of air propulsion.

1. 1896-The "Pneumatic Locomotive": In Paris, engineers experimented with using compressed air to power locomotives. These pneumatic- powered trains were tested, though they faced limitations such as lack of efficiency and insufficient air storage. C Mid-20th Century Developments
2. 1930s-1940s- Air-Powered Vehicles in the US and Europe: During the early to mid-20th century, there were more experimental designs for air-powered vehicles, including small cars and buses powered by compressed air. However, they struggled to compete with internal combustion engines and lacked the necessary technology for efficient air storage and compression.
3. Post-WWII - Increased Interest in Alternative Energy: With growing interest in alternative fuels and green technologies, pneumatic vehicles began to regain some attention. However, technological limitations kept them from widespread adoption. D Late 20th Century Exploration and Research
4. 1970s-1980s - Oil Crises and Environmental Concerns: During the global oil crises, there was renewed interest in alternative transportation technologies, including pneumatic power. Demo Model of Air Operated Vehicle Sharad Institute Of Technology Polytechnic Yadrav. Page2Some studies and prototypes of compressed air vehicles were created, particularly for city transport.

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5. 1980s - The Compressed Air Car: Some inventors and companies in Europe and the United States began creating more practical Proto types of compressed air cars, aiming for zero-emission vehicles powered by stored compressed air. E 21st Century - Modern Pneumatic Vehicles

- 2000s - Advancements in Technology: In the 2000s, companies like Motor Development International (MDI) in France and Tata Motors in India began developing compressed air vehicles with more practical applications for urban commuting.
- 2010s - Increased Research into Sustainable Transportation: As electric and hybrid vehicles gained popularity, pneumatic vehicle technology also saw some investment for use in niche markets (e.g., city cars, public transport). • Recent Years: Research into pneumatic vehicles has continued, with a focus on improving air storage efficiency, increasing the range, and integrating compressed air engines with electric systems. Companies like Air car (Slovakia) and Zero Pollution Motors (USA) have developed prototypes for mass production, though these vehicles have not yet seen large scale adoption.

II. LITERATURE REVIEW

The development of pneumatic vehicles has been an area of interest for researchers and industries aiming to explore alternative energy sources for transportation. Several studies and experiments have been conducted to analyze the feasibility, efficiency, and challenges of compressed air powered vehicles. This literature survey reviews existing research, case studies, and technological advancements related to pneumatic vehicle systems. 1. Historical Background and Concept of Pneumatic Vehicles

- The concept of using compressed air for propulsiondatesbacktothe19thcentury,with Early applications in railway locomotive sand underground transportation.
- Researchers have explored various designs of air-powered engines that utilize pneumatic cylinders for converting compressed air energy into mechanical motion.
- Modern developments focus on using pneumatic actuators, free wheel mechanisms ,and electronic control systems for vehicle automation. 2. Existing Research on Pneumatic Vehicles
- Tata Motors' Air Car Project (MDI Engine, 2007): o Tata Motors collaborated with Motor Development International (MDI) to develop a compressed air engine for small urban vehicles. The study highlighted low running costs and zero emissions, but efficiency and range limitations remained a challenge.
- Compressed Air Energy Storage (CAES) System (2012, MIT Research): o Research conducted at the Massachusetts Institute of Technology (MIT) explored the potential of high-pressure air storage to improve pneumatic vehicle performance. o The study suggested that energy losses during air compression and expansion significantly impact efficiency.
- Hybrid Pneumatic-Electric Systems (2018, SAE International Journal of Engines): o A study published in the SAE International Journal proposed a hybrid system combining compressed air with electric power to enhance the efficiency of urban transport vehicles. o The research demonstrated that a hybrid approach improves energy utilization and extends range while maintaining environmental benefits.

CAD MODEL

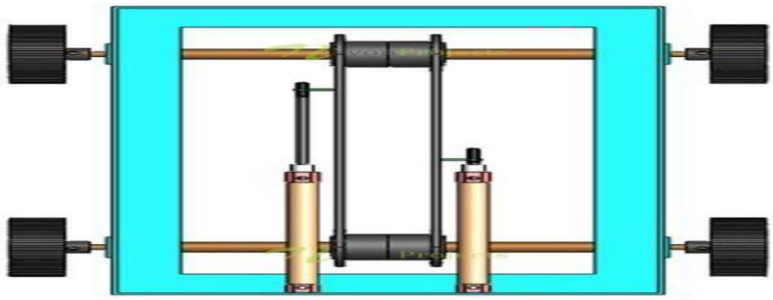

Figure1LAYOUTOFPNEUMATICVEHICLE.

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III. COMPONENTAND SPECIFICATION

Sr.No.	Components	Specifications	Qty.
1.	**Frame Structure**	20mmx20mmMSpipes	1
2.	**Pneumatic Cylinders**	○ StrokeLength:**150mm** ○ BoreDiameter:**16mm**	2
3.	**Chain and Sprocket Mechanism**	○ **High tensile strength** to with stand mechanical loads. ○ **Wear-resistant** for extended operational life. ○ Ensures **efficient power transmission** With minimal energy loss.	1
4.	**Compressed Air Storage Cylinder**	• **10-litercapacity**	1
5.	**Direction Control Valve**	○ **Type**:5x2SingleSolenoid Direction Control Valve	1
6.	**Wheels**	**100mmdiameterwheels**	4

IV. CONCLUSION

Pneumatic vehicles represent a promising alternative to traditional transportation, offering significant environmental and economic benefits, including zero emissions, reduced noise pollution, and lower operating costs. They are particularly well-suited for short-range, urban, and last-mile mobility applications, where their advantages of quick refueling and simplicity could be fully realized. However, the technology faces limitations, such as limited range, challenges in compressed air storage, and a lack of refueling infrastructure

,which need to bead dressed for wider adoption. The future scope of pneumatic vehicles looks promising, with potential advancements in air storage technology, renewable energy integration, and hybrid systems that could improve performance and efficiency. As research and development continue, pneumatic vehicles could play a key role in the transition to sustainable, eco-friendly transportation, especially in urban environments. With improvements in technology, cost reduction, and infrastructure development, pneumatic vehicles could become a practical, clean, and efficient solution to the world's growing transportation challenges.

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2. Introduction to Fluid Power–JamesL.Johnson
3. Various research papers on pneumatic-powered vehicles and sustainable transportation technologies.

Technical Manuals &Datasheets:
1. Datasheet of Pneumatic Cylinders (Stroke Length: 150mm, Bore: 16mm)
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6. Pneumatic Control System Tutorials: https://www.festo.com
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2. Trends in alternative energy-powered transportation systems.

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