Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

DESIGN AND FABRICATION OF WATER SAVING MECHANISM IN TOILET FLUSHING.

V. VIGNESH Lecturer, Mechanical engineering
J FRANKLIN[1] J MARUTHANAYAGAM[2] S PANDIKARUPPU[3] T PRABAKARAN[4] S THIRUMURUGAN[5] C VADIVEL[6] [1]Diploma in Mechanical Engineering, Murugappa Polytechnic College, Chennai -600062
Email: kashikd152006@gmail.com)

----------**********----------

Abstract:

The concept behind this project is to conserve water for public use by using natural resources through simple mechanical and electrical equipment's. It uses compressed air and less water to clean Indian toilets after usage. Using wind mill, the air is compressed and stored in a cylinder. The wind mill simultaneously stores electricity in a battery and used as alternative in absence of wind mill as alternate to compress air. We will also include a flush tank as a last resort to provide uninterrupted service to the public in case of air and power failure. We want to utilise the waste water also.

Keywords — regarding water conservation

----------**********----------

I. INTRODUCTION

Water saving mechanism in toilet flush system using air pressure to enhance flushing efficiency while reducing water consumption. In this mechanism we use compressed air inside a sealed tank to force water into the bowl with high pressure, ensuring a powerful flush with less water.

Water is one of the most vital natural resources essential for sustaining life, yet it is increasingly under threat due to population growth, urbanization, and climate change. In modern households, a significant portion of water usage is attributed to toilet flushing, which can account for nearly 30% of total indoor water consumption. Traditional toilet systems often discharge excessive amounts of water per flush, leading to unnecessary wastage.

To address this issue, the development of efficient and cost-effective water-saving mechanisms in toilet flushing systems has become a key area of focus in sustainable design and engineering. This project presents the design and fabrication of a novel water-saving mechanism that optimizes water usage without compromising hygiene performance. The proposed system is intended to be simple, adaptable, and environmentally friendly, aiming to contribute toward water conservation efforts in both residential and commercial applications.
Through this project, we aim to reduce daily water usage, promote sustainability, and inspire the adoption of eco-conscious practices in sanitary technology

II. PROPOSED SYSTEM

The proposed system introduces a water-efficient flushing mechanism designed to reduce water consumption in toilets while maintaining effective waste disposal. The system is based on a dual-mode operation—providing the user with two flushing options based on the type of waste: a low-volume flush for liquid waste and a high-volume flush for solid waste.

III. SYSTEM DESCRIPTION

The proposed water-saving toilet flush system operates using a compressed air-assisted flushing mechanism, which significantly reduces the volume of water needed per flush while maintaining high flushing efficiency. This method utilizes the kinetic energy of compressed air to forcefully discharge a smaller quantity of water through the toilet bowl, effectively clearing waste with less water.

IV. Technical Specifications:

Component	Specification
Flush Type	Compressed air-assisted flush
Tank Capacity	6–8 liters (standard); effective flush with ~3–4 liters
Working Pressure	2 – 4 bar (30 – 60 psi)
Air Compression Method	Manual pump or mini electric air compressor
Flush Valve	High-pressure solenoid or mechanical ball valve
Material (Tank & Pipes)	Corrosion-resistant HDPE / PVC / Stainless Steel
Pressure Control	Integrated pressure relief valve and analog pressure gauge
Float Mechanism	Adjustable float to control water refill level
Mounting Type	Wall-mounted or concealed (depends on design)
Discharge Time	1.5 – 2.5 seconds (fast flush)
Air-Water Mixing Ratio	1:1 to 1:2 (adjustable based on desired flushing force)

V.WORKING PRINCIPLE

The compressed air-assisted flushing mechanism operates on the principle of using stored air pressure to enhance the force of water discharge during toilet flushing. Unlike traditional gravity-based systems, this mechanism leverages the kinetic energy generated by compressed air to deliver a high-speed, low-volume flush that efficiently clears waste with significantly less water.

Step-by-Step Operation:

Filling Phase: The flush tank is partially filled with a predetermined amount of water (typically 3–4 litres).

Simultaneously, air is compressed and stored in the upper portion of the tank using either a manual pump or a mini electric compressor.

Storage Phase: The tank maintains both water and compressed air in a pressurized state.
A pressure gauge and relief valve ensure safe operating pressure (usually 2–4 bar).

Flush Activation: When the user activates the flush (via a button or lever), a high-speed valve opens.
The compressed air exerts pressure on the water, instantly forcing it out through the flushing line.

Discharge Phase: The water is discharged at high velocity, providing an effective flushing force despite reduced water volume.

The design ensures turbulent flow, improving cleaning efficiency and bowl clearance.

DESIGN CALCULATIONS:

The design of the compressed air-assisted water saving flushing system must meet the following functional, structural, and safety requirements to ensure effective operation, durability, and environmental benefit.

Functional Requirements

Efficient Flushing: Must clear both liquid and solid waste effectively with reduced water volume (3–4 litters per flush).

Quick Response: Flush operation must be completed within 2–3 seconds to ensure user convenience.

2. Mechanical Requirements

Tank Design: Must accommodate water (~3.5 L) and compressed air (~10.5 L at atmospheric pressure).

Must withstand pressure up to 4 bar with safety margin.

Flush Valve: Fast-acting, pressure-tolerant valve capable of releasing water quickly and cleanly.

Sealing: All joints and components must be leak-proof to prevent pressure and water loss.

Material Strength: Tank and piping materials must be corrosion-resistant and pressure-rated.

3. Pneumatic Requirements

Air Compression: System must include a manual or electric compressor/pump to pressurize air to 2–4 bar.

Air Storage: Sufficient volume to provide consistent flush force over repeated use.

Safety Valve: Must include pressure relief to prevent over-pressurization.

Pressure Monitoring: A gauge should be present for maintenance and operation checks.

4. Water Management Requirements

Float Valve System: To control refill water level in the tank after each flush.

Backflow Prevention: System must include anti-siphon or backflow valves to protect water source.

5. User & Environmental Requirements

User Friendly: Flush mechanism should be easy to operate and require minimal effort.

Noise Level: System should operate below 60 dB for user comfort.

Water Conservation: Should reduce water consumption by at least 40–60% compared to traditional toilets.

Eco-Friendly Materials: Use recyclable or non-toxic materials where possible.

DESIGN DIAGRAM

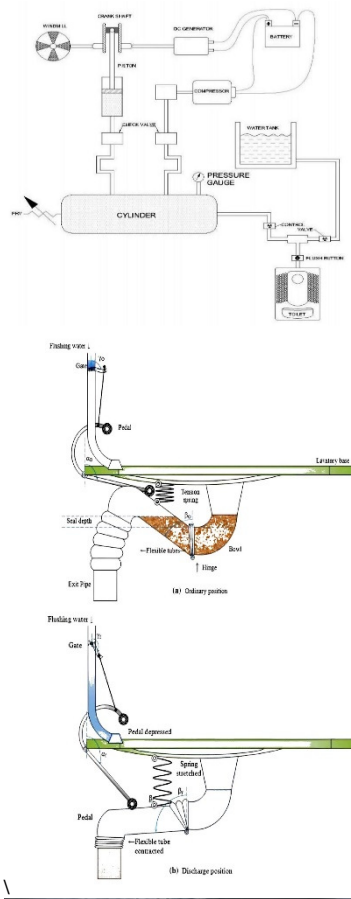

Fig: Water saving toilet flushing **system**

VI.CONCLUSION

The development of a compressed air-assisted water-saving toilet flushing system demonstrates a practical and innovative approach to addressing water scarcity through engineering. By integrating compressed air with controlled water discharge, the system effectively reduces the volume of water required per flush while maintaining excellent flushing performance.

This mechanism not only contributes to significant water conservation, especially in high-usage environments, but also promotes sustainable sanitation practices with relatively low operational cost and maintenance. The design is compact, adaptable, and environmentally friendly, making it suitable for both residential and public restroom applications.

With further refinement, automation, and widespread adoption, this technology has the potential to play a vital role in the global effort to conserve water resources and build eco-friendly sanitation infrastructure.

REFERENCES

1. World Health Organization. *Water, Sanitation and Hygiene: Key Facts.* https://www.who.int
2. EPA (United States Environmental Protection Agency). *Water Sense Program – Toilets.* https://www.epa.gov/watersense
3. Tilley, E., Ulrich, L., Lüthi, C., Reymond, P., & Zurbrügg, C. (2014). *Compendium of Sanitation Systems and Technologies.* 2nd Revised Edition. Eawag, Swiss Federal Institute of Aquatic Science and Technology.
4. S. C. Rangwala, *Water Supply and Sanitary Engineering*, Charotar Publishing House, 2013.
5. Rajput, R.K., *Engineering Materials and Metallurgy*, S. Chand Publishing, 2006.
6. Zhao, Y., & Liu, W. (2017). *Design and simulation of compressed-air-powered toilet flushing system.* International Journal of Environmental Science and Development, 8(2), 108–112.
7. Khoshnevisan, M., & El Hanandeh, A. (2020). *A review of toilet flushing technologies to reduce water consumption.* Journal of Cleaner Production, 250, 119511.
8. Plumbing Engineering Services Design Guide. *Water Supply Systems and Sanitary Design Principles.* Chartered Institute of Plumbing and Heating Engineering (CIPHE), UK.

