e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:01/January-2025 Impact Factor- 8.187 www.irjmets.com

FABRICATION OF AN AUTOMATIC DRINAGE SYSTEM FOR SOLID WASTE REMOVAL USING SOLAR PANNELS

Sathyanarayana V*1

*1Department Of Mechanical Engineering, Vidyavardhaka Polytechnic, Mysuru, Karnataka, India.

ABSTRACT

Water is a vital resource for all life on Earth, covering approximately 70% of the planet's surface. Despite this, a large portion of water is unsuitable for drinking or other essential uses. Clean water is increasingly in demand for various purposes such as drinking, bathing, cleaning, and cooking. Impurities in water can lead to serious health issues, threatening human life.

In urban and industrial environments, drainage systems face significant challenges due to the accumulation of solid waste, including empty bottles, plastic bags, papers, and other debris. If left unaddressed, these materials can cause blockages, leading to water overflow, contamination, and costly repairs. To solve this issue, an **automatic drainage cleaning system** has been designed to remove solid waste from drainage water, ensuring the continuous flow of water and preventing blockages.

The primary function of this system is to use mechanical claws, powered by a chain sprocket mechanism, to automatically collect and dispose of debris. The claws are triggered whenever waste is detected in the drainage system. Once activated, the claws grasp the solid waste and transport it to a waste bucket for disposal. This process allows the drainage system to be continuously monitored and cleaned without manual intervention.

Keywords: Automatic Drainage System, Solid Waste Removal, Health Issues, Claws.

I. INTRODUCTION

In the modern era, drainage systems face significant challenges, especially due to waste and gases produced by industries, which are harmful to both human beings and the environment. With the rapid expansion of industries, sewage water and waste management have become urgent issues that need to be addressed promptly to prevent further environmental degradation.

Cleaning drains and gutters has traditionally been a labour-intensive and risky task. Workers involved in manual gutter cleaning are exposed to various health hazards, including infections and poisoning from waste and chemicals. Additionally, objects such as plastic bottles and other debris frequently clog gutters, leading to blockages and overflow, which disrupt the drainage flow. To tackle these modern-day gutter jamming issues, we propose an automated drainage cleaning system.

Our proposed system uses an automated mechanism that allows water to flow freely while catching large solid waste, such as bottles and plastic. The waste is then accumulated and stored in a waste tank. This eliminates the need for workers to clean the entire gutter floor manually; instead, they only need to clean the automated cleaning units installed at specific points along the gutter.

The system consists of metal teeth-based jaws mounted at the bottom of a vertical frame, allowing liquid to flow through the grids. The teeth are connected to a chain, which is driven by a motor. When the motor runs, it rotates the chain, causing the jaws to lift and capture solid waste. The waste is then lifted and stored in a waste storage tank. After a specified time interval, the jaws rotate and dump the collected waste before returning to their original position to continue the process.

This system operates with low power consumption, as the motor only needs to rotate once or twice a day to empty the waste storage tank. The mechanical control techniques used in the system, including gathering, destroying, cutting, and rotating, ensure efficient waste management. The system works similarly to mechanical aquatic harvesters (reapers) that are used for managing aquatic vegetation and removing waste from water bodies, such as lakes, harbors, and drainage systems.

In addition to waste collection, the system helps control the drainage level by utilizing an auto-mechanism that is monitored by municipal authorities. The motor, chain, driver, bucket, and frame work together to ensure efficient operation of the system. Waste like bottles and other debris floating in the drain are caught by the teeth connected to the chain, which is powered by the motor. As the chain circulates, the teeth lift the waste, which is then stored in the waste tank, ensuring continuous water flow and preventing blockages.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:01/January-2025 Impact Factor- 8.187 www.irjmets.com

II. METHODOLOGY

Finite element For Drainage solid waste cleaning methodology is given below; this methodology gives way about how work is to be carried out in systematic way. It is standard process of describing process, how it is done in simplest manner.

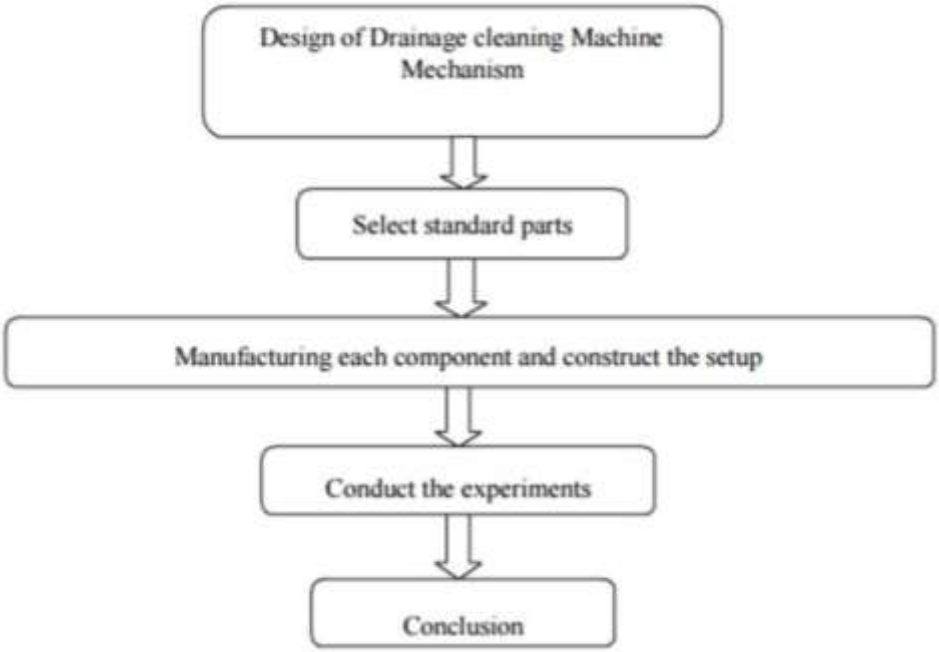

Fig 1: Block diagram of Solid waste removal

III. DESIGN DESCRIPTION

The design process involves the application of logical guidelines, specialized knowledge, and creativity to develop new components that perform specific functions efficiently and economically. A systematic approach to design is crucial for achieving the desired outcomes. The overall design work has been divided into two main sections:

1. **System Design**
2. **Mechanical Design**

1. SYSTEM DESIGN

System design focuses on addressing various physical limitations, ergonomic considerations, space requirements, and the arrangement of components within the system framework. The key factors considered in system design include:

- **Man-Machine Interaction**: This involves the number of controls required, their positioning, and their ease of use for operators. Proper ergonomics ensures that the system is user-friendly and accessible.
- **Space Requirements**: The system must be designed to fit within the allocated space while maintaining optimal functionality. This includes the arrangement of components and ensuring adequate clearance for operation and maintenance.
- **Machine Weight**: A detailed assessment of the total weight of the machine, including its weight from the ground level, is essential for ensuring stability and ease of handling during operation and transportation.
- **Maintenance Workplaces**: The design must allow easy access to maintenance areas for system checks, repairs, and routine cleaning.
- **Flow of Waste and Water**: The arrangement of the various parts must allow fluid (water) to flow freely while catching solid waste, such as bottles and plastic. The system must function smoothly without obstruction.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:01/January-2025 Impact Factor- 8.187 www.irjmets.com

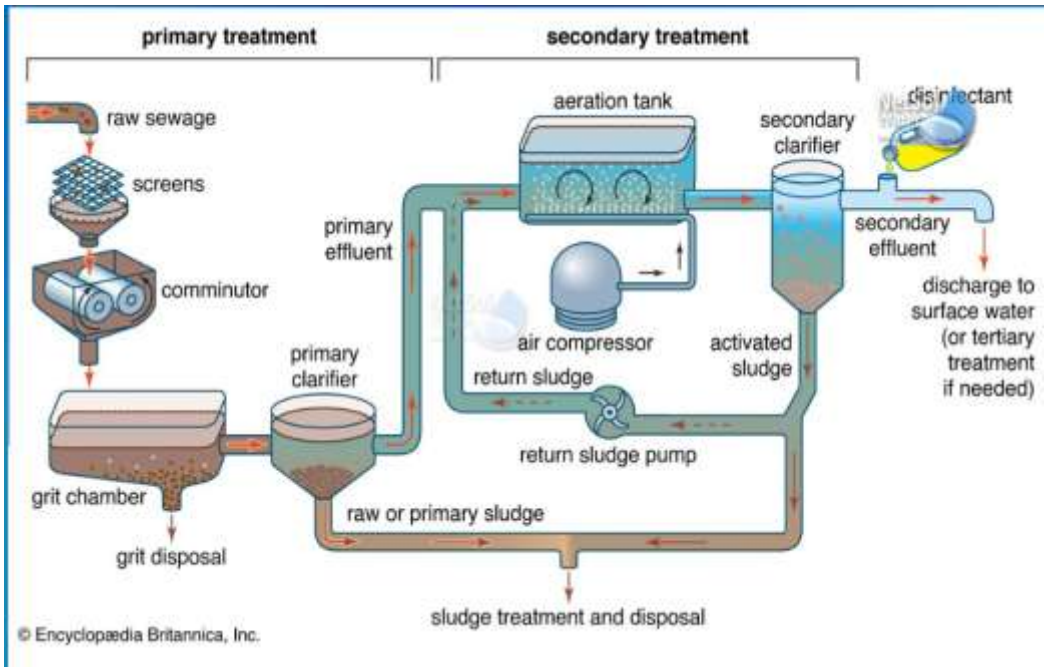

Fig 2: System Layout and Component Placement

2. MECHANICAL DESIGN

In the mechanical design phase, various components required for the system are identified and categorized based on their procurement. The components are divided into two categories:

1. **Designed Parts**: These are custom-engineered parts that are specifically designed for the system's functionality and performance.
2. **Parts to be purchased**: These are off-the-shelf components that are readily available from external suppliers.

The mechanical design stage is critical because the success of the entire project depends on the accurate analysis of the design and components. During this phase, many preliminary design options are evaluated and eliminated based on efficiency and practicality. The designer must have a strong understanding of the physical properties of materials, load stresses, and failure mechanisms. All internal and external forces acting on the machine parts must be identified to ensure the system operates reliably.

IV. DISCUSSION

ADVANTAGES

1. **Low-Cost Drainage Solution**: The system offers a cost-effective solution for cleaning and maintaining existing drains, especially where drainage infrastructure is already in place.
2. **Locally Available Materials**: Construction materials for the system are often locally available, reducing costs related to procurement and transportation.
3. **Job Creation**: The system's development, installation, and maintenance create job opportunities for the local workforce, promoting economic growth.
4. **Portability**: The system is portable, which allows it to be easily relocated to different areas as required for different drainage systems.

LIMITATIONS

1. **Minor Vibrations**: Some vibrations may occur due to the connection of the wire brush wheel, which could affect the system's stability and efficiency.
2. **Proper Installation Required**: To minimize vibrations and ensure optimal performance, the system must be securely mounted and properly installed on the ground or floor.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:01/January-2025 Impact Factor- 8.187 www.irjmets.com

APPLICATIONS

1. **BMC (Municipal Corporation)**: The system can be used by municipal corporations to maintain and clean urban drainage systems, ensuring that they remain blockage-free.
2. **Plastic and Thermocol Separation**: The system can be utilized to separate plastic, thermocol, and other waste materials from sewage, promoting cleaner wastewater management.
3. **Plastic Industries**: In the plastic manufacturing industry, the system can help manage plastic waste and prevent clogging in drainage systems.
4. **"GANGA SEVA ABHIYAN"**: If mounted on a boat, the system can be used as part of the "Ganga Seva Abhiyan" initiative, a campaign for cleaning the Ganges River. This helps remove floating debris and plastic waste, contributing to the environmental health of the river.

V. CONCLUSION

This automated drainage water cleaning system offers an innovative, efficient, and low-cost solution for managing drainage problems caused by waste and sewage. It helps prevent blockages, reduces manual labor, and promotes a cleaner environment. With its portability and ability to be used in various settings, including urban drainage systems, plastic industries, and environmental initiatives, this system is a valuable tool in modern waste management.

VI. REFERENCES

[1] Sall, Prof. Nitin, Mohammed Zaid Chougle, Sadique, Prathmesh Gawde, Qureshi, Shiraz, Bhadauriya, Sunil Singh, "Vol. 4, Issue 2, February 2016."

[2] Kumaresan, Dr. K., M.E., Ph.D., S., Prakash, P., Rajkumar, C., Sakthivel, G., Sugumar, "ISSN: 2349-9362 (ICEIET - 2016)."

[3] Yadav, D., "Garbage Disposal Plant Mired in Controversy," India Times, TNN, 19 Feb 2009.

[4] Bharat, K., and Mihaila, G.A., "When Experts Agree: Using Non-affiliated Experts to Rank Popular Topics," ACM Transactions on Information Systems, 20(1), (2002), pp. 47-58.

[5] Sathiyakala, R., Flora Grace, S., Maheswari, P., Bhanu, S. Majitha, Lakshmi, R. Muthu, "Vol. 4, Issue 2, February 2016."

[6] Astrup, T., Mollee, J., and Fruergaard, T., "Incineration and Co-combustion of Waste: Accounting of Greenhouse Gases and Global Warming Contributions," Waste Management & Research, 27:789-799, 2009.

[7] Department of Civil Engineering, Michael Okpara University of Agriculture, Umudike Abia State, "March 2014."