

INVESTIGATION ON DESIGN AND FABRICATION OF MOTORIZED WATER TANK CLEANER

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ABSTRACT

One of the important natural resource we have water. We use water for drinking, washing clothes etc. So it is essential to keep drinking water clean. Until now, to clean tank manual method is available in which labor needs to enter into the tank to clean it. Manual method is inefficient because water contains mud, Algae, bacteria which badly effect on human health. As the drinking water from overhead tank is not fresh so it our responsibility to keep it fresh. In order to overcome the above problems, we need to have an alternative method, so we are introducing a solution motorized water tank cleaner. In motorized water tank cleaning system, we have used mechanical system for cleaning overhead tank. Mechanical system includes a rack and pinion arrangement, a motor, battery, brushes and arm with brushes. In this project the arms can be adjusted as per dimensions of the tank. Brushes are attached at the end of arms. Once the adjustment is made then switched on the machine, motor takes the power from battery and rotates the shaft with high torque and low RPM, the brushes mounted on the end of arms starts scrubbing the inner walls of the tank. Rack and pinion arrangement is provided to entire system for up and down movement.

Keywords:

Overhead water tanks, Cleaning, Hygiene, Community Health

INTRODUCTION**INVESTIGATION ON DESIGN AND FABRICATION OF MOTORIZED WATER TANK CLEANER**

Every day the water stored in the tank. Stored water is used for Domestic and industrial purpose which include drinking water, agricultural farming, irrigation in agriculture. The tank used to store water for various purposes can be made of a fiber glass, plastic, Concrete, stone and Steel. Pure drinking water is one of the fundamental factors for people to maintain healthy life. Over the period of time sludge and scale deposition gets formed on the inner walls and bottom of the tank. The sediments pollute the water make it unfit to use. Cleaning overhead water tank is tough because it requires many different tools, equipment and most important is the time. And to ensure better and effective cleaning we need to have good labor. Manual cleaning is boring and time-consuming task. Also manual cleaning may expose the worker to toxic or corrosive substances. So, the design and development of motorized water tank cleaner has a significant importance and impact on domestic and industrial applications.

SIGNIFICANCE

The Motorized water tank Cleaner is a vital mechanical system in domestic cleaning equipment for usage of safe and clean water. By design and fabrication of this motorized water tank cleaner setup, we can improve the usage safety of the water stored in overhead water tanks. Simple Solution: The designed and fabricated mechanical setup is so simple that even unskilled person can efficiently use the system. The mechanical arrangement of the components is very simple and the maintenance of this setup is also very easy and cost effective. Improved cleaning efficiency: This system also improves the cleaning efficiency of the overhead tank cleaning process. Improved Water Quality: By using this system we can maintain and improve the water quality.

LITERATURE SURVEY

Shelke Prasad “Automatic Water Tank Cleaning Machine” Feb 2017. In this design a mechanical system includes two main mechanisms which are rack and pinion gear mechanism and reciprocating four bar linkages mechanism. The rack and pinion arrangement are used to move the entire setup up and down for cleaning the cylindrical tank. The rack is fixed on the motor and four bar mechanism is attached to the motor shaft. PVC brushes are attached to the ends of four bar linkages. The linkages are made in such a way that they can be adjusted according to inside diameter of the tank. This method was more effective and safer than the conventional methods. This method is capable to clean water tanks with less time and with less human efforts.

P.Prem Kumar “Autonomous Water Tank Cleaning Robot for Indian Household” Mar 2018 In this the method uses a robot to clean the tank. The robot first moves in the forward direction and the arm will move in up and down as well right and left direction to pump out high pressure water to the walls of the tank. In case of heavy scaling inside the tank, chemical agents can be mixed with the cleaning water. When the robot completes the entire cleaning process in the forward direction, it again reaches its default tank centre position.

Mahadev Chavan “Design of Automatic Water Tank Cleaning Machine using Catia Software” Oct 2018. They did design in Catia software. Cleaning of tank was done by rotating brushes. It is found that the mechanism is small but the supporting construction which is holding the mechanism is very large that’s why the hole assembly is very big in size.

R.Raffik “Automatic Tank Cleaner” Dec 2018. they have used Arduino based system for cleaning the tank main component include Arduino Board Mega, Linear Actuator, Metal Gear Servo: Mg995, Submersible Pump, Nozzle, Metal Gear Servo: Rki-1201 , L293d Motor Driver. Water forced through rotary jet nozzles are rotated by using a servo motor, creating a 360° cleaning pattern. The system is best suited for cylindrical tanks. the apparatus is portable from place to place, hence commonly can be used for many outdoor applications.

Ashwin Chander “Design and Fabrication of Water Tank Cleaning Machine” Jul 2019. They design and developed machinery for cleaning domestic rectangular water tanks. The system consists of a rack and pinion, wiper motor, and brushes. The mechanism is controlled using wiper motor. Mechanism supporting a rotating brush, the movement of shaft & brush scrubs the walls of the tank. Sprinkler mechanism ruins the sediment deposits from walls of the tank & additionally a vacuum device ingests the sludge from the floor of the tank. Shaft is rotated at a speed of 100 rpm. it is also found to be heavy in weight.

Akshay Sawansukha “Intelligent Based Design and Development of Overhead Water Tank Cleaning Machine” Jul 2021. In this the entire mechanical system is fitted into the tank through a manhole in retract position, this is done manually. After this Lubricant is sprayed throughout the inner wall & bottom of the tank for easy cleaning with help of a pipe that is attached to the submersible water pump. Initially, the base of the system should touch the bottom of the tank. Switch ON the motor. Once motor start, the main shaft will start rotating in turn the C-type foldable rod also starts rotating. The brushes attached to the edge of the C-type rod will start cleaning the inside wall and bottom of the tank. After the cleaning is done switch off the motor and remove the assembly from the tank. The system could be more compact and lighter in weight. Enhancement in the design to improve the effectiveness.

OBJECTIVES

- This project’s objective is to develop and fabricate a mechanical system setup for cleaning household water tanks.
- This project’s objective is to develop and fabricate a mechanical system setup for cleaning commercial overhead water tanks.
- This project’s objective is to develop and fabricate a mechanical system setup for cleaning water tanks in low cost.
- This project’s objective is to develop and fabricate a mechanical system setup in such a way that even unskilled person can efficiently use it.
- This project’s objective is to develop and fabricate a mechanical system setup which can work without human intervention.

METHODOLOGY

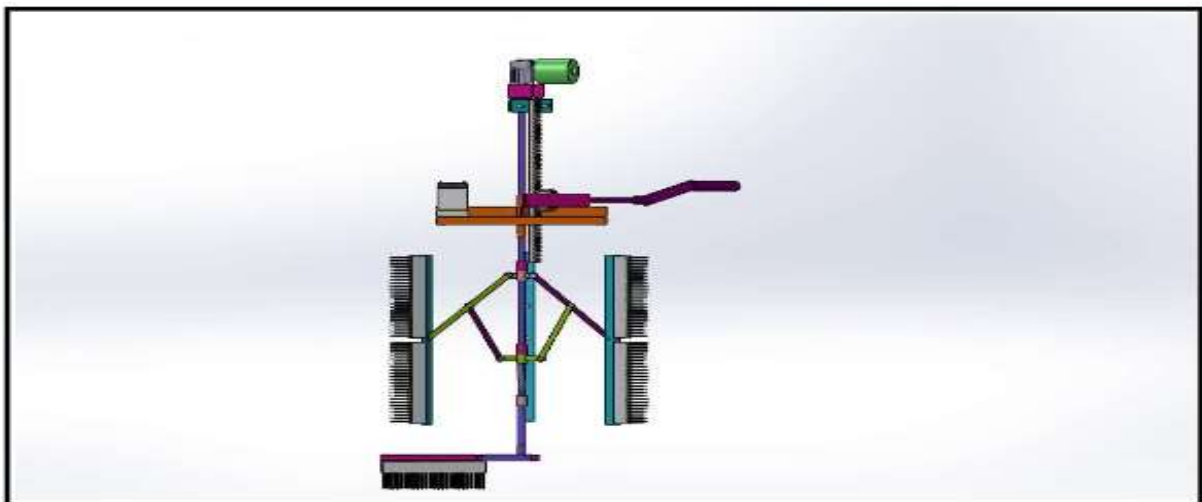
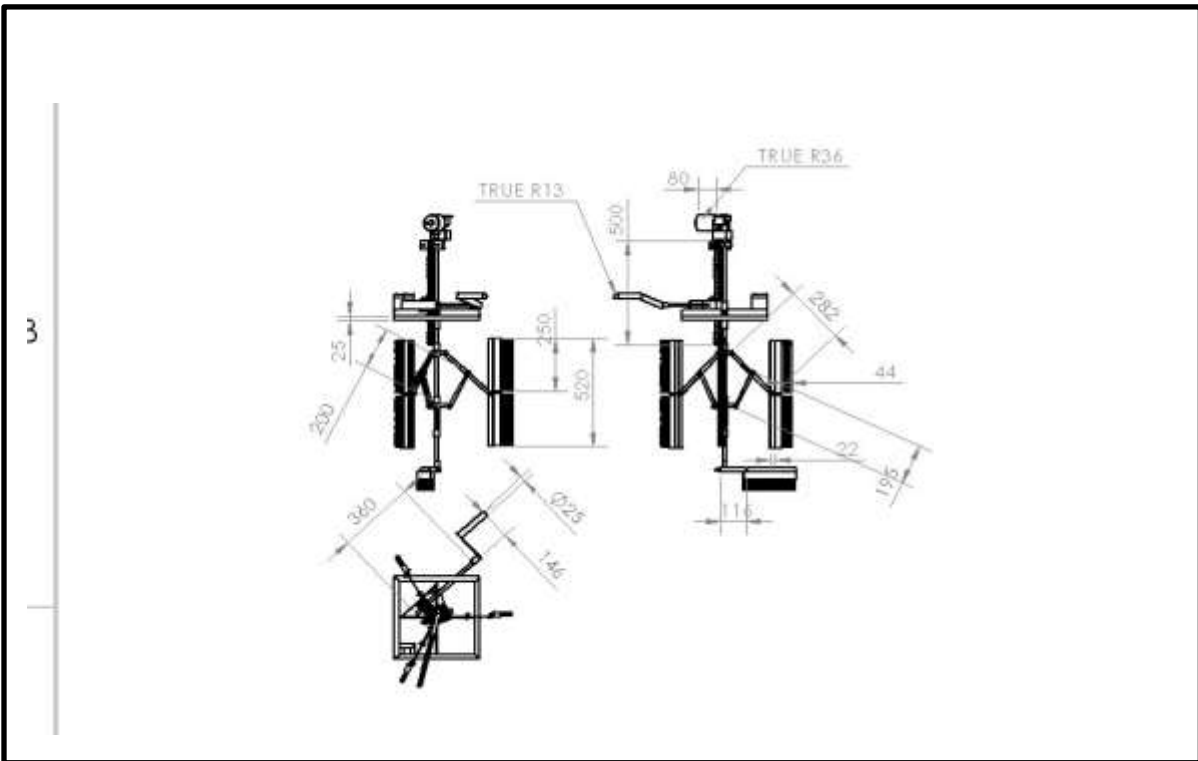
- Completely drain the entire water tank.
- Insert the water tank cleaner machine in the tank
- Perform the necessary adjustments as per the required diameter
- Switch on the supply
- After switching on the supply, the motor will start which will also rotate the shaft
- The connector is mounted over the shaft
- The linkages are connected to the connector
- The brushes are joined at the end points of the linkages
- The brushes make a firm contact with the inner wall of the water tank
- When the supply is on then the brushes rub against the inner wall and perform the cleaning action
- Then again fill some water in the tank
- After filling water, drain the tank completely
- Hence by using this machine we can successfully clean the overhead water tanks

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MODELLING



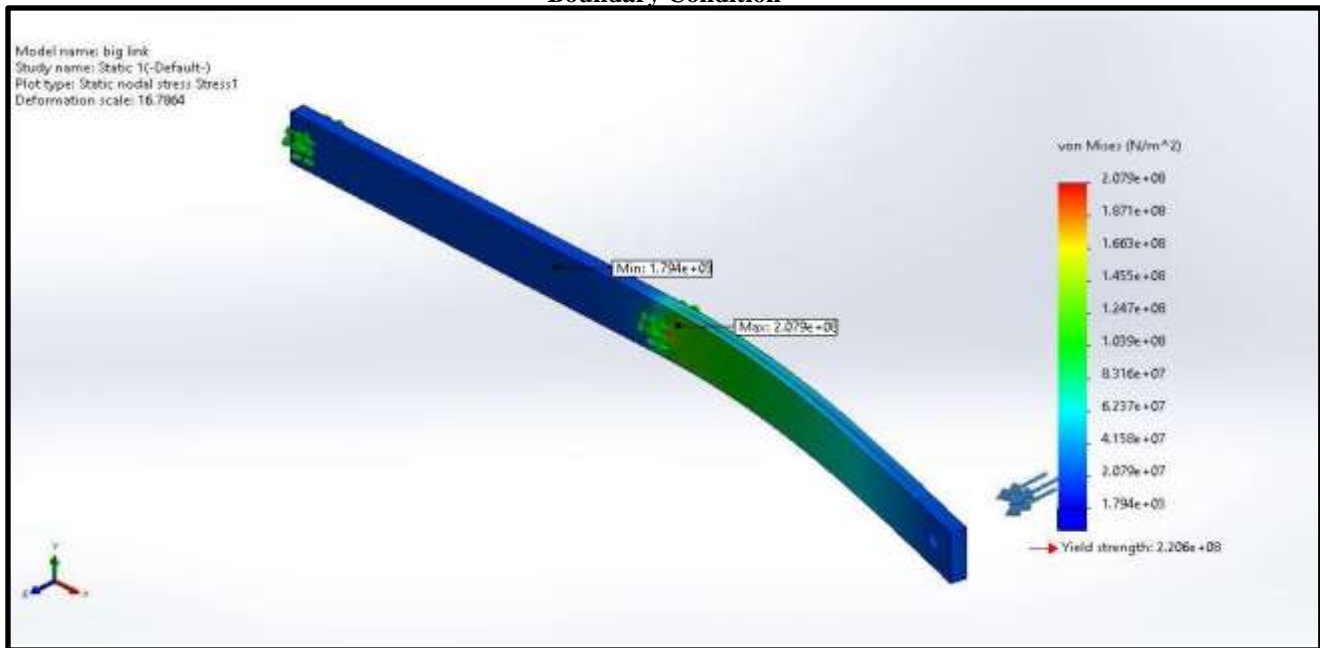
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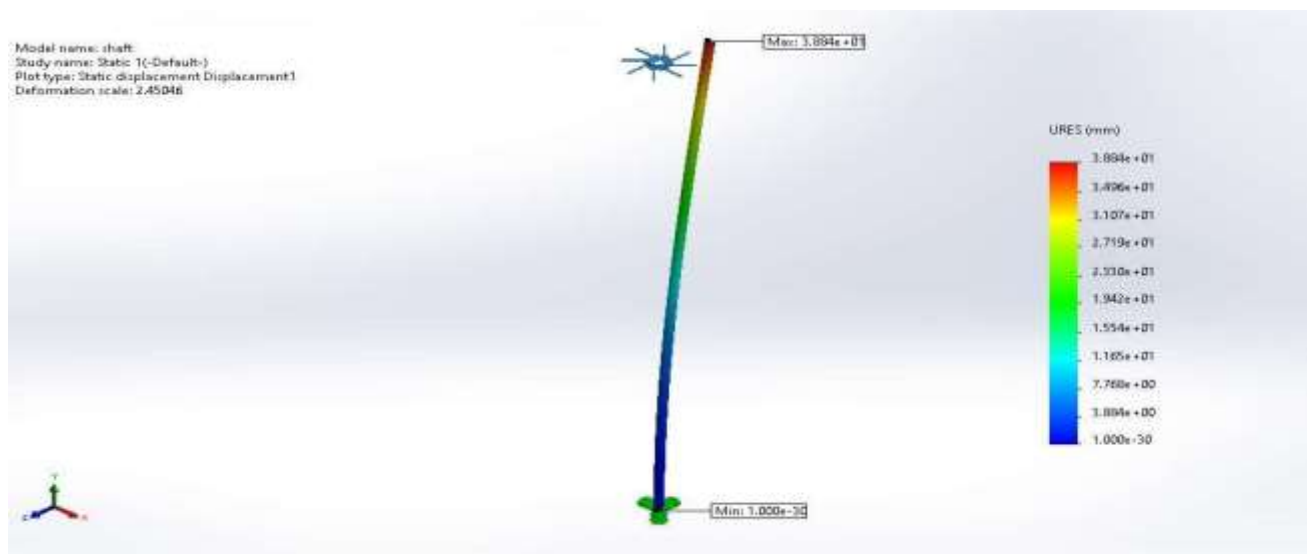
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ANSYS MODEL

Boundary Condition



Deformation and Load Concentration



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DESIGN ANALYSIS

Material	Mild Steel C 45
Total force on Brushes	8.10 Kg
Total Torque on Shaft	25.46 N-m
Force on each Link	79.5 N
Factor of safety	2
Stress (N/mm ²)	68.09

APPLICATION

- This project's application is for cleaning household water tanks.
- This project's application is for cleaning commercial overhead water tanks.
- This project's application is for cleaning water tanks in low cost.

CONCLUSION

In conclusion, the development of a mechanical system for cleaning cylindrical water tanks, specially overhead tanks, addresses the challenges associated with stagnant water, dust accumulation, and impurities that can affect the quality of stored water. The project aims to reduce human efforts, eliminate the need of chemical cleaning agents, and provide a more efficient and time saving solution.

By implementing a rack and pinion arrangement, the mechanical system allows for the reciprocating and rotating movement of PVC brushes attached to a four-bar linkage mechanism. This setup enables thorough cleaning of the tank's internal walls, promoting high safety standards, increased efficiency, and reduced cleaning time.

The mechanical system offers several advantages over traditional methods. It minimizes the risks associated with human entry into the risk for cleaning, which can be hazardous and time-consuming. Additionally, by eliminating the use of chemicals, it mitigates potential health risks and avoids environmental pollution problem.

The project's focus on providing a reliable and innovative solution for cleaning water tanks underscore the importance of maintaining clean water for drinking and general usage purposes. It aims to overcome the tediousness and inefficiency of manual cleaning processes while ensuring the safety and well-being of individuals involved.

Overall, the developed mechanical system for cleaning cylindrical water tanks offers high safety standards, increased efficiency, reduced human efforts, and a decreased reliance on chemicals. It addresses the modern challenges associated with tank cleaning and contributes to providing clean and healthy water for domestic and commercial use.

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GUIDE



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