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Design and Development of Overhead Water Tank Cleaning Machine

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Abstract: ***To design a overhead water tank cleaning machine which will be able to remove sand and mud (SEDIMENTS) from the bottom of the tank without fully emptying the tank. While cleaning overhead tank, we have to remove all water from the tank and one has to enter the tank and clean it manually. Generally, it has been observed that mud and sand particles are settled down to the bottom of the tank. It is difficult to clean the tank in a week due to which the taps and pipes gets damaged. Emptying the tank all the time is a waste of water and time. We have an idea to clean the tank when it is partially filled. In our project we are saving time and no need to enter into the tank, it will be cleaned weekly or whenever needed. Aim of this project is to develop a mechanical system for cleaning domestic cylindrical water tank. The mechanical system uses PVC pipe arrangement for stand and water suction arrangement. A box attached to the suction motor with help of PVC pipe arrangement. Initially, after starting the suction motor it sucks the clean water at the same moments put off the motor and placed the pipe with box attached to bottom there is vacuum created and due capillary action bottom sediments with muddy water getting suck. In this way, the box is moved total bottom area of tank by using some arrangement and to clean the tank. The purpose of this project is to reduce the human efforts and to avoid the chemical influence on health of person entering the tank for cleaning.***

I. INTRODUCTION

In recent studies it has been found that no automation based machine used in cleaning of overhead tank. This is because of the irregular shape and various heights of the tank locations cleaning is the process of removing unwanted substances, such as dirt, infectious agents, and other impurities, from an object or environment. This can eventually clog pipes. It is not hygiene which results damages the skin and it will effects on the health. The success of a tank cleaning job depends on many factors such as thorough planning of the cleaning job, the design of tanks, cleaning machines and their operation, design of piping, heating capabilities etc. So came to a conclusion that cleaning the overhead tank using automation process can be useful to solve all these problems. In this case, machine has the capability to clean the tank easily and quickly. Designing of our machine is based on the survey report conducted. Hence water tank cleaning is very important. The main objective of this paper is to develop an automated water tank cleaning device. This device contains suction motor and reciprocating pipe arrangement to suck the sand and muddy water from bottom of the tank. It reduces human efforts and time required for cleaning.

II. LITERATURE SURVEY

This section presents the critical analysis of existing literature which is relevant to overhead water tank cleaning system and its mechanisms. Though, the literature consists of a lot many research contributions, but, here, we have analyzed around five research and review papers. The existing approaches are categorized based on the basic concepts involved in the mechanisms. The emphasis is on the concepts used by the concerned authors, the database used for experimentations and the performance evaluation parameters. Their claims are also highlighted. Finally, the findings are summarized related to the studied and analyzed research papers. Section concludes with the motivation behind identified problem influence on health of person entering the tank for cleaning.
1.Shubham srivastav "design and development of cylindrical water tank cleaner", January 2016. In this work they design mechanical system consists of two main mechanisms which arc gear mechanism and reciprocating four bar linkage mechanism. The gear used is worm gear which is used to reciprocate whole mechanical system up and down according to the height of cylindrical tank. Four-bar attach to the main shaft and its other end is attached to PVC brushes. Four bar linkage is designed in such a way that it adjusts according to inside diameter of the tank. When the ac motor is switch on the main shaft rotate in turn the linkage rotates and with the help of brushes, the wall and bottom of tanks gets cleaned. He conclude that overhead water tanks cleaning equipment's was conceived and developed.

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This equipment was found to be effective in cleaning cylindrical overhead tanks. During cleaning the rotating brush needs to move up and down manually for complete cleaning with the help of rotating handle of worm gear. The cleaning is carried out by rotating brushes at constant speed (120rpm).

2. Shelke prasad k. "automatic water tank cleaning machine" , February 2017.in this design a mechanical system includes two main mechanisms which are rack and pinion gear mechanism and reciprocating four bar linkage mechanism. The rack and pinion arrangement is used to move whole mechanical system up and down for cleaning the cylindrical tank. The rack is fixed on the motor and the four-bar mechanism is attached to the motor shaft. PVC brushes are attached to the ends of the four-bar linkage. Four bar linkage is made in such a way that it can be adjusted according to inside diameter of the tank. When the motor is started the linkage rotates and with the help of brushes, cleaning of wall and base of tank takes place. He concludes that the water tank cleaner was used to clean the water tanks by using rotating brushes. This method was more effective and safe than the conventional methods. This method is capable to clean water tanks within less time and human efforts.

3. S. Abhishekhet “design and fabrication of automatic system overhead tank cleaning” 4, April 2017.in this work present a concept of the mechatronics system consists of a grooved gear rod attached to two arms with brushes at ends. The two arms are connected to the gear rod by nut. By rotating the gear rod, the up and down motion of the two arms is achieved. The gear rod is rotated with the help of a d.c gear motor. The main grooved shaft is powered by an a.c motor. The motor and the shaft are connected by a rubber belt. The clockwise rotation of the main shaft will make the arms move and vice versa. The whole operation is controlled by a circuit consisting of relay switches, buttons, and pic microcontroller. The number of times for the operation to repeat can be fed into the circuit. He concludes that advanced model for tank cleaning system is cleaning the tanks thus making the operation user friendly. The working prototype is promising both in terms of imparting cleanliness and avoiding excess manpower.

4. Ms.Smitagourkhedeet, “design & fabrication of drain cleaning machine” in this work the construction of drain cleaning mechanism is very simple; the equipments required for the machine are less. It mainly consists of electric motor, bearing, belt and pulleys, and other small materials like angular bar, etc. Using this equipments the garbage is cleared from the drains which somewhat cleans the water. The main purpose of the machine is to clean the garbage from chocked drains and increase the flow of drain water from flowing through them. In our drain cleaning mechanism two electric motors are used, one electric motor which is used to rotate the pulley with the help of belt. The motor is used for uplifting the garbage from drain through a plate. An electric motor is an electrical machine that converts electrical energy into mechanical energy.

III. OBJECTIVE OF THE PROJECT

1) To design a overhead water tank cleaning machine which will be able to remove sand and mud sendiments from the bottom of the tank without emptying the tank.

2) For saving the time and water from getting wasted.

List of components

Sr.no	Components	Quantity
1	0.5inch PVC pipes	10 Feet
2	1 inch PVC pipes	1 Foot
3	Elbow joint	2
4	Suction box	1
5	T Joint	1
6	1 inch four way socket	1
7	0.5 to1 inch pipe reducer	2
8	2 Inch Socket	1
9	Bearing	1
10	12 voltBattery	1
11	12volt submersible pump	1
12	Electric cables	3 Metre
13	Flexible pipe	5 Metre
14	PVC solution	1
15	Teflon tape	1

Table1:- Specification of components

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IV. WORKING OF OVERHEAD WATERTANK CLEANING MACHINE

A. List of Components used in Fabrication of Cleaning Machine

- PVC Pipes



- Flexible pipe



- PVC Socket



- Bearing



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- Four side Socket



- T Joint socket



- Elbow



- Pump



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- Battery



- Suction box



B. Working

When all the mud sediment is settled down and the tank is partially filled with water, the whole setup is put into the tank and is settled to the bottom of the tank. When the suction box is settled to the base of the tank, the power from the battery is supplied to the pump and the pump starts. When the pump starts, it sucks the mud and the water which is inside the area of suction box is sucked in and gets discharged outside the tank. With the help of stand and adjusting rod, the suction pipe can be move in all direction as in stand there is a bearing which rotates in 360 degree and through the T joint the suction pipe can move in up-down direction. The sucked muddy water is collected into the empty container which can further be used in gardening purpose.

V. TESTING AND RESULT

A. For 500 Litre Tank

Diameter of the tank = 825 mm
Height of the tank = 1025 mm.
Diameter of the suction box=79mm
Therefore,
Number of placements of suction box to clean the whole tank
= diameter of the tank / diameter of suction box
= 825 / 79 = 10.44
Therefore, 11 placements of suction box on the base of the tank cleans the whole tank.

Time required to clean the area covered by the suction box = 30 sec.
Therefore, time required to clean the whole tank=Number of placements of suction box on the base of the tank * Time required to clean the area covered by the suction box
= 11*30 = 330 sec
Therefore, time required to clean the whole tank = 330 sec = 5min 30 sec.

VI. CONCLUSION AND FUTURE SCOPE

The water tank cleaner was used to clean the water tanks by using rotating brushes. This method was more effective and safe than the conventional methods. This method is capable to clean water tanks within less time and human efforts. Advanced model for tank cleaning system is cleaning the tanks thus making the operation user friendly. The working prototype is promising both in terms of imparting cleanliness and avoiding excess manpower. The future scope of the project is to extend it with auto feeding mechanism by which the manpower involved in feeding gets removed. Through the help of the auto feed mechanism it is easy to clean the tanks without excess man power. The project can be even extended to increase the cleanliness of the tank by insulating the frame and other components using PVC pipes.

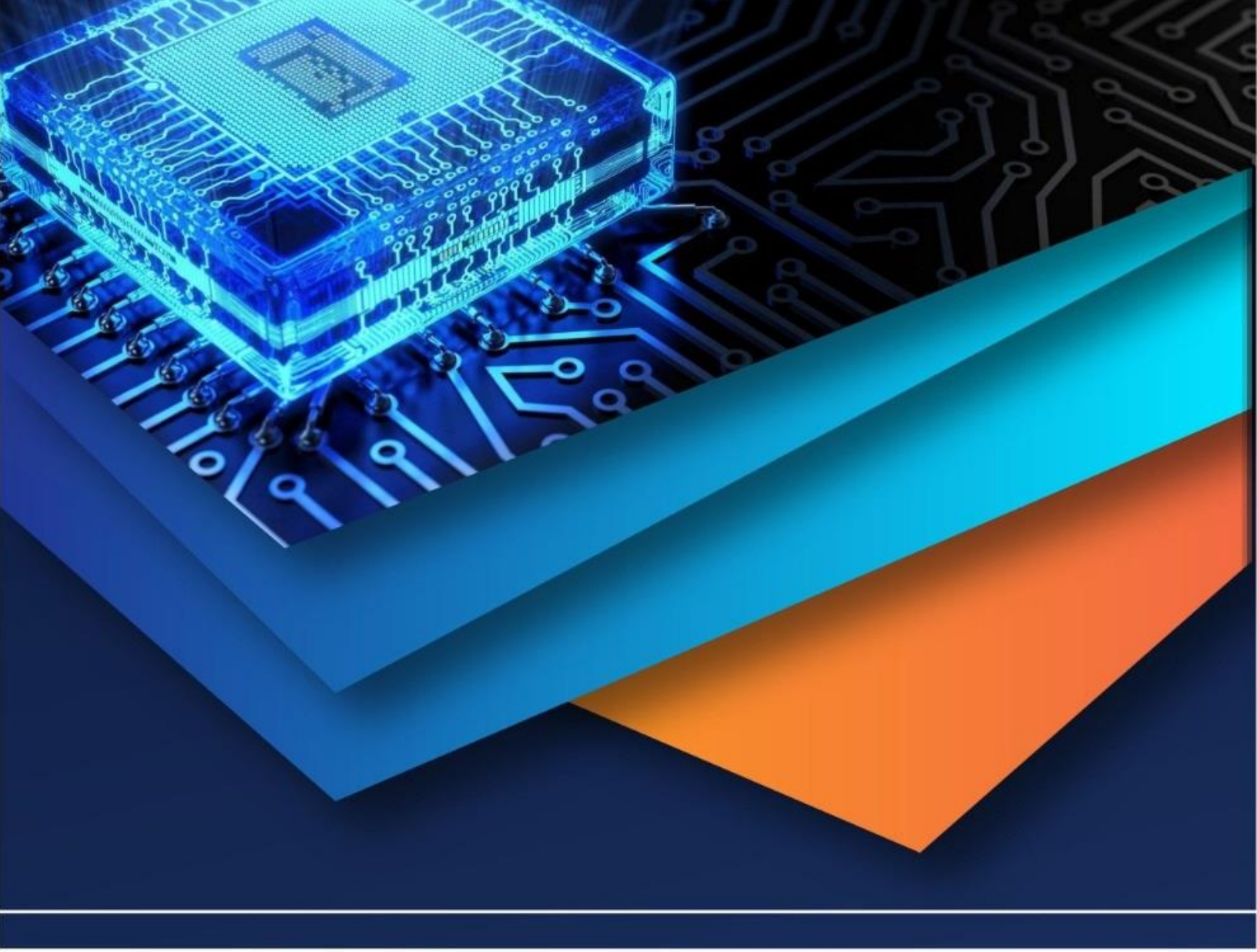
A. Future Scope

This system is user friendly and time saving also the cost is less hence it can be used in the future water tank cleaning purpose.
The system would be more compact and light weighted and more user friendly and efficient by improvement in design and using some other advanced equipment.

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