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A Review on Advancement in Automatic Overhead Water Tank Cleaner

Sandhya Shrivastava
Faculty of Electrical Engineering
SRMGPC, Lucknow, India

Manvendra Singh
Student of Electrical Engineering
SRMGPC, Lucknow, India

Rajanikant Shukla
Student of Electrical Engineering
SRMGPC, Lucknow, India

Priyanka Singh
Student of Electrical Engineering,
SRMGPC, Lucknow, India

***Abstract*— Purpose of this paper is to find the solution of cleaning the household water tank used for water storage. The work is done by using two different mechanisms (a)Pinion-Rack system (b)Four Bar Linkage system. In Pinion-Rack method we use a motor and connect it to a Rack. A shaft is connected to the motor and a four-bar linkage is joined to it. For cleaning the walls of the overhead tank we make use of PVC made brushes and attach them to the ends of four bar linkage and for cleaning the floor we join a circular disc to the bottom end of the shaft. The disc has some thickness. The bottom and the periphery of the disc is covered with PVC brushes. This setup is designed , such that it can fit itself according to the diameter of the water tank. When this whole setup is placed inside the cylindrical overhead water tank and switched on, the motor starts to rotate the shaft, the disc and four bar linkages. The Brushes are moved up and down by making use of pinion-rack mechanism.Thus cleaning operation is performed.**

The society is tending towards automation day by day, cleaning the tank manually is undesirable as it requires lots of time and efforts. So, to solve this problem, this household water tank cleaning system is developed that is more efficient , more safe, less time consumption and of course no extra human efforts. It doesn't affect the environment and human health in any way. Here a rod having grooves is placed in which brushes are attached through two arms. For rotation of the arms we connect a DC gear motor and a AC motor to main rod. The system also consists of microcontroller and relays for controlling purposes.

Keywords*—*Water tank cleaning, Cylindrical, four bar Linkage, Motor Shaft, Rack and Pinion, PVC brush.

1.INTRODUCTION

From previous researches and studies it is found, people normally avoid the cleaning of overhead water tank because it is very troubleshooting to clean the tank manually. They have to face various problems likewise – working in the dirty spaces, regular payment problems, use of irritating and harmful chemicals and so many other reasons. In public sectors like schools, bus stops, railway stations, restaurants and hotels etc., in most of the cases nobody pays attention towards cleaning the tank due to involved extra cost and efforts. Hence this project is very useful for solving all these problems. The problem associated with this project was that people uses different types of overhead water tanks with different dimensions and shapes, but according to a report we found that in India approximate 71 % people uses syntax tanks and most of them were 500-liter capacity. So, the project designing of the cleaning machine is adopted by keeping in mind the shape and size of 500-liter syntax tanks. but the job is done in a way that the cleaning mechanism can adjust itself if a little much variations occur the shape and size of the tank. So come to a conclusion by keeping all the problems and needs of cleaning the tank in mind this project is made, that is the solution for all the above problems.

2. DISCUSSION

2.1 Need of Cleaning of Water tanks

Water is one of the most important basic need, without which one cannot think of life. According to a survey every person consumes nearly 100 gallons (approx. 455 liters) of water every day. Water is used for brushing, bathing, cleaning, drinking, moping, and other household jobs. So, for fulfillment of our daily needs, water is stored in cylindrical shaped overhead water tanks for continuous supply.

With passage of time these tanks become dirty. Sediment's algae grows inside the tank and scale starts to deposit on the tank walls.The algae growing in water is so harmful and called *Algae Bloom.*

These impurities make water unfit for use. Drinking algae affected water or consuming food can lead to so many diseases, can also affected the liver and Nervous system. Bacterial infections may also occur hence cleaning of the tank is necessary.

2.2 Methods of cleaning

In previous years the cleaning was done by manually scrubbing and rubbing of the tank walls and floor to remove dirt caused by algae and scale.This is the most troubleshooting method of cleaning as it requires more time and extra labor. In some places chemicals are also used for cleaning the tanks. These chemicals are very harmful for the person coming in contact. So, the use of chemicals may also be avoided. In some places pressurized water is sprayed to remove the dirt from the walls of the water tank. But it also requires more efforts and time.

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S no.	Paper Details	Operating mechanism	Research Objectives	Outcomes
1	W. S. N. Trimmer and K. J. Gabriel (1987)	Micromotor based system used for cleaning the tank.	Motor having high torque and less rpm with a small size.	Average performance
2	Brown J. A (1989)	Vacuum tanker system.	It has two functions. Firstly, it acts as vacuum cleaner Secondly, it filters out the water with more pressure	Efficient for big tanks but uneconomical in case small overhead tank.
3	M.S. Triantafillou and G. S. Triantafillou, (2003)	Water as a swimming vehicle, and used for allowing swimming pools by utilising motor with mechanical cleaning arrangements.	Robot based system that can clean the tank more effectively underwater.	Overall good result but not so durable and more sensitive to faults.
4	Dr.R.K. Bansal (2011)	Kinematics of machine.	None	Good study
5	Shubham Shrivastava, Hari Om Kumar (2016)	Cylindrical Water tank cleaning system.	Performance is good and very effective in cleaning the overhead water tank.	Easy to operate, radiate but very large size and heavy weight.
6	Pray osha innovative (2017)	Sedi Mclean water tank Cleaner based of vacuum cleaner type system.	It removes sediments without extracting water. It works similar to vacuum cleaner.	Don't clean other impurities in water such as scale, algae etc.
7	Thonge Suraj, Shelke Prasad, Wakte Vaibhav, Thonge Sharad, Prof. Shinde, (2017)	Pinion-rack system to clean the tank mechanically.	The authors claimed more effective cleaning than the Conventional (manual) methods of cleaning.	Fitting of the system is an issue.
8	S. Abhishek, D. Kiran, P. Praveen and Dr. K. L. Senthil Kumar (2017)	Pinion-Rack system	The authors claimed more effective cleaning than the Conventional (manual) methods of cleaning.	Fitting of the system is an issue.

Table 1: Literature Review

To find such an approach that is more efficient and best suited for tank cleaning process so there is a need to study previous approaches and researches regarding the task. After analyzing so many approaches and researches conclusion is presented through a summerized table of literature review.

2.3 Proposed Approaches

This section of the paper presents the formulation of the identified problem. All the reviews on theoretic approaches are somewhat similar to each other and adopting nearly same technologies.

The previously discussed methods are inefficient, more time taking and requires more human interventions.

So, we require a solution to overcome the limitations of previously discussed techniques.

Therefore, new designing is developed as per requirements of cleaning .

2.4 Experimental Review

In previous years the cleaning was done by scrubbing and rubbing the walls and floors of the tank using manual labor but this was very time consuming and troubleshooting method. Due to this people started to avoid cleaning of the tank. After sometime for ease of proper cleaning people started to use various high strength acidic chemicals to clean the tank properly and quickly. Use of chemicals although reduced the human efforts for cleaning but there were so many harmful effects of chemicals to the person coming in contact. Hence,

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after watching so many problems associated cleaning of the tank and keeping in mind the importance of cleaning first mechanical cleaning system was developed by using Rack and Pinion with PVC brushes, four bar linkages and motor.

In figure1 motor is connected to the rack and through rack pinion is attached and a handle is joined to the pinion. With the help of this rack pinion arrangement the whole cleaning mechanism can be moved up and down. There is a shaft connected to the motor and we join a four-bar linkage to this shaft. For cleaning the walls of the overhead tank brushes of PVC are used by attaching them to the four bar linkages and for cleaning the floor we join a circular disc to the bottom end of the shaft. The disc has some thickness. The bottom and the periphery of the disc is covered with PVC brushes. The whole setup is developed in such a way that it can fit itself according to the size of the tank When this setup is placed inside the cylindrical overhead water tank and switched on, the motor starts to rotate the shaft, the disc and four bar linkages. The Brushes are moved up and down with the help of pinion-rack mechanism. In this way the cleaning of the tank is performed.

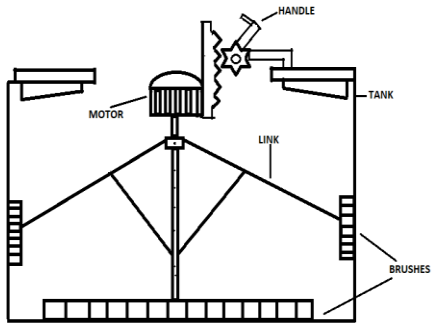

Figure 1: Model of Rack and Pinion Method

In another approach figure2 of cleaning the overhead water tank the machine is designed such that a grooved shaft is placed at the center of the tank and that is rotated by an AC motor along with the brushes that are connected through two arms to the shaft .The arms make use of compressed spring to adjust themselves according to the size of the tank within its limits. A DC motor is also utilised here to moves the brushes horizontally from starting to ending point of the shaft. The bottom end of the shaft is joined to a disc having brushes of PVC at the periphery and bottom surface in order to clean the tank floor.

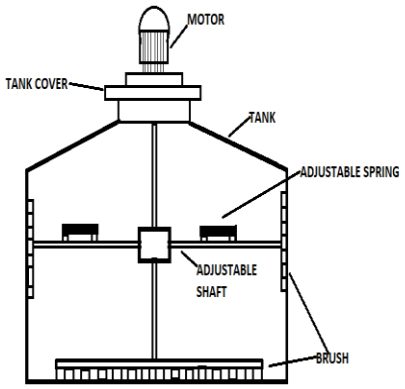

Figure 2: Showing Adjustable Automatic Overhead Water Tank Cleaning System

The machine specifications are –

a) A single phase AC motor (0.25 hp, 220V, 75rpm)
b) A microcontroller
c) A DC motor (24 V DC)

3. CONCLUSION AND FUTURE SCOPE

The most common problem with all the previously discussed approaches is that in all the above methodologies none is completely automation-based system in which no human intervention is required. In all the above approaches the problem of fixing the cleaning mechanism inside the tank occurs. It takes time and efforts that are undesirable. Also, if the dirty water left after cleaning of the water tank reaches inside the water supply pipe lines, it chokes the pipes and taps. So, in the modern society that is tending towards complete automation in every field day by day these types of problems are undesirable.

Hence, we decided to work on a project that is complete automation based in which no human intervention is required. Also, there is no issue of fixing the mechanism manually. There are so many smart features all associated with the cleaning system such as water level indicator, auto on/off pump, pH level indicator, smart drainage system to avoid blockage of water pipe lines and more

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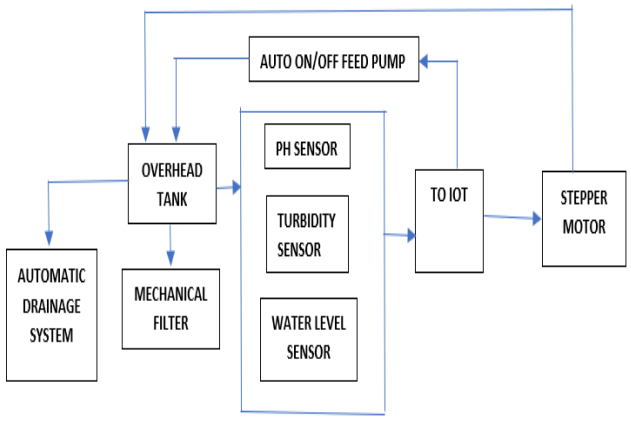

Figure 3: Showing Block Diagram of Automatic Overhead Tank cleaning system

In figure3 the whole process does not require any effort as it is based on IOT and can be easily controlled by smartphones. It saves lots of time and efforts and also provide more safety and better cleaning and also prevents the losses of water.

4. REFERENCES

[1] International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 7, Issue 3, March 2018 Copyright to IJAREEIE DOI:10.15662/IJAREEIE.2018.0703017 1139 Autonomous Water Tank Cleaning Robot for Indian Household

[2] International Journal of Advanced Engineering Research and Science (IJAERS) [Vol-5, Issue-10, Oct- 2018] ISSN: 2349-6495(P) | 2456-1908(O) www.ijaers.com Page | 185 Automatic Overhead Water Tank Cleaning System: A Review and an Approach

[3] M. S. Triantafillou and G. S. Triantafillou, "An efficient swimming vehicle". Guo, T. Fukuda, and K.Asaka, "A new type of fish-like underwater microrobot," IEEE/ASME Trans. Mechatron., vol. 8, no. 1, pp. 136–141, Mar. 2003.

[4] W. S. N. Trimmer and K. J. Gabriel, "Design considerations for a practical electrostatic micromotor," Sens. Actuators, vol. 11, no. 2, pp. 126-173, Jan. 1987.

[5] Brown J. A., "vacuum tanker for cleaning storage tanks," Process Engineering, vol. 21, no. 5, pp.138- 180, Sep. 1989.

[6] © 2019 JETIR May 2019, Volume 6, Issue 5 www.jetir.org (ISSN-2349-5162) JETIRCJ06151 Journal of Emerging Technologies and Innovative Research (JETIR) www.jetir.org 716 WATER TANK CLEANER

[7] International Journal of Scientific & Engineering Research Volume 11, Issue 6, June-2020 ISSN 2229-5518Fabrication of Water Tank Cleaning Machine

[8] T. Schaub, "Spread frequency shift keying", IEEE Trans. Commun., vol. 42, no. 4,pp. 182-296, Aug. 1993.

[9] Dr. R. K. Bansal, " Kinematics of machine", Laxmi Publications (P) Ltd ., vol. 1, no. 4, pp. 23-287,Nov. 2011.

[10] Shubham Shrivastav, Hari Om Kumar, "Design and Development of Cylindrical Water tank cleaner", IEEE Trans. Commun.,vol. 6, no. 1, pp. 1-7,Feb. 2016.

[11] Prayosha innovative, " sedimclean water tank cleaning machine", Prayosha innovative, vol. 1 no. 1, pp.1-177,Feb. 2017.

[12] Guha, A., Ronald, M. Barron., and Balachandar, R., [2011] an experiment and numerical study of water jet cleaning process. Journal of materials processing technology 610-618.

[13] Pramod B Jachaket "Computerized Underwater Robot to Clean Water Tank". Volume:2, Issue:4, 201.

[14] Davis, J. and Lambert, R., [2002] "state there are three steps for conventional and disinfecting a water tank".

[15] Ahmad AthifMohdFaudzi, "Clean Water Supply is Important in Ensuring Good Health of people.

[16] Dr. R. K. Bansal, "Kinematics of machine", Laxmi Publications (P) Ltd ., vol. 1, no. 4, pp. 23-287,Nov. 2011.

[17] Vikramsingh R. Parihar, Graph Theory Based Approach for Image Segmentation Using Wavelet Transform, International Journal of Image Processing (IJIP), Volume 8, Issue 5, pp 255-277, Sept 2014.

[18] Vikramsingh R. Parihar, Heartbeat and Temperature Monitoring System for Remote Patients using Arduino, International Journal of Advanced Engineering Research and Science (IJAERS), Volume 4, Issue 5, PP 55-58, May 2017.

[19] Vikramsingh R. Parihar, Power Substation Protection from Lightening Over voltages and Power Surges, International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering (IJIREEICE), Volume 6, Issue 6, pp 26- 31, June 2018

[20] Vikramsingh R. Parihar, Automatic Wireless Health Monitoring System, Reinvention International: An International Journal of Thesis Projects and Dissertation, Volume 1, Issue 1, pp 84-95, Aug-2019

[21] Vikramsingh R. Parihar, Transmission Line Protection Analysis using STATCOM, International Journal of Advanced Trends in Technology, Management and Applied Science (IJATTMAS), Volume 3, Issue 11, pp 23-26, Nov 2017

[22] Vikramsingh R. Parihar, A Review on Transmission Line Fault Detection Techniques, International Journal of Advanced Trends in Technology, Management and Applied Science (IJATTMAS), Volume 3, Issue 11, pp 27-32, Nov 2017

[23] Vikramsingh R. Parihar, Transmission Line Protection using Distance Relays, International Journal of Electrical, Electronics and Communication Engineering (IJEECE), Volume 3, Issue 1, pp 1-15, Nov 2017

[24] Vikramsingh R. Parihar,Protection of Power Transformers using Artificial Neural Network and Fuzzy logic, International Journal of Advanced Trends in Technology, Management and Applied Science (IJATTMAS), Volume 3, Issue 11, pp 72-79, Nov 2017

[25] Vikramsingh R. Parihar, Control System Security: An Issue, Journal of Control System and Control Instrumentation (MAT Journals), Volume 3, Issue 3, pp 1-5 , Dec 2017

[26] Vikramsingh R. Parihar, Resilient Designs of Control Systems Analysis and Review, Journal of Control System and Control Instrumentation (MAT Journals), Volume 3, Issue 3, pp 1-9 , Dec 2017

[27] Vikramsingh R. Parihar,Industrial Control System Cyber Security: Review & Recommendations, Journal of Network Security Computer Networks (MAT Journals), Volume 3, Issue 3, pp 1-9 , Dec 2017

[28] Vikramsingh R. Parihar,Operational Analysis of Infrared Gas Sensor, Journal of Instrumentation and Innovation Sciences (MAT Journals), Volume 4, Issue 1, pp 1-5 , Dec 2017

[29] Vikramsingh R. Parihar, Automatic Fault Detection in Transmission Lines using GSM Technology, International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering (IJIREEICE), Volume 6, Issue 4, pp 90- 95, April 2018

[30] Ayob Johari et.al., "Tank Water Level Monitoring System Using GSM Network", International Journal Of Computer Science And Information Technologies, Vol. 2 (3) , 1114- 1120, 2011.

[31] Priya J, Sailusha Chekuri,"Water Level Monitoring System Using Iot" , International Research Journal Of Engineering And Technology (IRJET), Volume: 04 Issue: 12 | Dec-2017.

[32] Ihedioha Ahmed C. And Eneh Ifeanyichukwu I., "Water Level Monitoring And Control Using Fuzzy Logic System" , International Research Journal Of Engineering And Technology (IRJET), Volume: 02 Issue: 08 , Nov-2015.

[33] Ejiofor Virginia Ebere, Oladipo Onaolapo Francisca, "Microcontroller Based Automatic Water Levelcontrol System", International Journal Of Innovative Research In Computer And Communication Engineering, Vol. 1, Issue 6, August 2013.

[34] Pooja .Narkhede, Ajay Bholane, Riyaz Mirza , Prof. Parag Jawale, "Water Level Monitoring By Using PLC", International Journal Of Research In Advent Technology (IJRAT), National Conference "CONVERGENCE 2016", 06th-07th April 2016.

[35] A. Shome And D. Ashok, "Fuzzy Logic Approach For Boiler Temperature And Water Level Control'," International Journal Of Scientific And Engineering Research, Vol.3,Pp. 1-6, 2012.

[36] Bin-Da Liu And Chun-Yueh Huang, In Transactions On Systems Man And Cybernetics-Part B: Cybernetics, Volume 27, No.3, Pages 475-487, June 1997.

[37] D. Wu, F. Karray, I.Song, "Water Level Control By Fuzzy Logic And Neural Networks" IEEE Conference On Control Applications, Pp.3134-39, 2005.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 11 Issue 01, January-2022

[38] G.K.Park And P.H.Seong, “Application Of A SelfOrganizing Fuzzy Logic Controller To Nuclear Steam Generator Level Control”, Nuclear Engg., Design, Vol.167, Pp.345-356, 1997.
[39] J. Mounika1, N. Siva Kumar Reddy, “Water Monitoring System Based On GSM”, International Advanced Research Journal In Science, Engineering And Technology, Vol. 3, Issue 7, July 2016.
[40] Judy Hodgson, Trey Walters, “Optimizing Pumping Systems To Minimize First Or Life-Cycle Cost”, Proceedings Of The 19th International Pump Users Symposium,Pp1-8,2002.
[41] Khaled Reza, S.M., Shah Ahsanuzzaman Md. Tariq, S.M. Mohsin Reza, “Microcontroller Based Automated Water Level Sensing and Controlling”: Design And Implementation Issue”Proceedings Of The World Congress On Engineering And Computer Science, Pp 220-224, 2010.
[42] T. L. Dinh, W. Hu, P. Sikka, P. Corke, L. Overs and S. Brosnan, “Design and Deployment of a Remote Robust Sensor Network: Experiences from an Outdoor Water Quality Monitoring Network,” Local Computer Networks, 2007. LCN 2007. 32nd IEEE Conference on, Dublin, 2007, pp. 799-806.
[43] Peng Jiang,Zheming Wang,“Design of water environment monitoring system based on wireless sensor network,” IEEE 2nd International Conference on Industrial and Information Systems, pp., 2010.
[44] K. A. U. Menon, D. P and M. V. Ramesh, "Wireless sensor network for river water quality monitoring in India," Computing Communication & Networking Technologies (ICCCNT), 2012 Third International Conference on, Coimbatore, 2012, pp. 1-7.
[45] A. S. Rao, S. Marshall, J. Gubbi, M. Palaniswami, R. Sinnott and V. Pettigrovet, "Design of low-cost autonomous water quality monitoring system," Advances in Computing, Communications and Informatics (ICACCI), 2013 International Conference on, Mysore, 2013, pp. 14-19.
[46] T. P. Lambrou, C. C. Anastasiou, C. G. Panayiotou and M. M. Polycarpou, "A Low-Cost Sensor Network for Real-Time Monitoring and Contamination Detection in Drinking Water Distribution Systems," in IEEE Sensors Journal, vol. 14, no. 8, pp. 2765-2772, Aug. 2014.
[47] Madrid, R. E., et al. "Multichannel bacterial growth analyser by impedance and turbidity." Medical and Biological Engineering and Computing 32.6 (1994): 670-672.
[48] Saba Mylvaganam and Torgeir Jakobsen,“Turbidity Sensor For Underwater Applications, Sensor Design and System Performancs with Calibration Results”, pp.158-161.
[49] World Health Organization and UNICEF Joint Monitoring Programme (JMP). Progress on Drinking Water and Sanitation, 2015 Update and MDG Assessment
[50] L Evison, and N Sunna, “Microbial regrowth in household water storage tanks,” Journal - American Water Works Association, vol. 93, Sep. 2001, pp. 85–94.