ISSN 2277-2685
IJESR/June. 2025/ Vol-15/Issue-3s/177-185
Ch. Shravani *et. al.,* /International Journal of Engineering & Science Research

Intelligent Overhead Water Tank Cleaner

Ch.Shravani. Ch. Vineetha, Pravalika Kantekar, Ramyasree Ambati, Moumita Nath
[1]Assistant Professor, Department Of EEE, Bhoj Reddy Engineering College For Women, India.
[2,3,4,5]B. Tech Students, Department Of EEE, Bhoj Reddy Engineering College For Women, India.

ABSTRACT

This project deals with design, development and implementation of an automated system for cleaning domestic cylindrical water tank. In an era marked by growing concerns over resource depletion, the pursuit of conservation of natural resources has become paramount. Water is one of them, vital for human survival, especially for drinking. While Earth is composed of about 75% water, only a small fraction is fresh and suitable for consumption. Therefore, it is our duty to save water, to keep it pollution free and as fresh as possible. Though the water pumped to homes is clean, storage conditions in overhead tanks can affect its quality. Hence, cleaning overhead water tank is very necessary. Manual tank cleaning poses health risks and the repeated procedure makes it boring & labour-intensive. An automated robotic system reduces human exposure to hazardous conditions, enhances efficiency, and minimizes labour costs. With proper integration, the whole cleaning process can be better managed saving in labour and time.

These factors motivate the development of an automated robotic cleaning system. As the system is automated, it includes an arduino controller, DC motor, Controlling circuit, hardware mechanism with brushes. The gas sensor continuously monitors the stink/stench of the internal tank or water and automatically activates the cleaning mechanism i.e., the DC motor will be activated by the the control unit designed using arduino controller which is used to drive the DC motor through the H – Bridge chip in the external electronic circuit. The H – Bridge IC is used as a driver circuit to operate the DC motor in both the directions inside the tank. Once the motor is switched ON, it draws power from the electric supply and rotates the shaft with low RPM and high torque, the brushes mounted on the mechanism starts scrubbing the water tank. The same operation can also be implemented in industries also with required modifications for cleaning boilers, chemical tanks, etc.

In this project only circular tanks are only cleaned, but further this can be enhanced to move the cleaning brush in horizontal direction by which any type of tanks can be cleaned. In future it is implemented by artificial intelligence which can clean any type of tank.

1- INTRODUCTION

Cleaning is the process of removing unwanted substance, such as dirt, infectious agents and other impurities from an object or environment. Water is one of those natural resources which is essential to each and every human being in there day to day life for many purpose and especially for drinking. We already know that 21% of entire water is fresh water which is used for human necessity therefore it is our responsibility that we should save water and keep it clean as much as possible and prevent it from being polluted. As of now, we are seeing that groundwater level is dipping every year and lot of algae and metallic elements get precipitate out and get sticks to water tanks. This can eventually block the pipes and result in accident. In recent searches in India it has been found that the use of tank by general population is about 71% after the examinations have made data that have faced a significant amount of

problems, such as persistent work in disordered places, sporadic delivery and different reasons.

Constant work and unpredictable installation can also be the important purpose behind this effort. So, we came to the conclusion that cleaning the upper tank using the mechanization process can be invaluable for tackling each of these problems. Water tanks are liquid storage containers. These tanks are usually used for storing water for human consumption. A water tank provides for the storage of drinking water, agriculture, farming and livestock, chemical manufacturing, food preparations as well as many other possible solutions. Water storage tanks must be maintained so that the quality of water in the tank is clean. Contaminated water can lead to diseases that can harm consumers, unscheduled tank cleaning will affect the health of users. In recent research, it has been found that no automation-based machine is used in cleaning of overhead water tank. This is because of the irregular shape and various heights of the tank locations. With previous survey made an attempt to make a machine by automation process for cleaning tank.

2- LITERATURE SURVEY

The literature survey has been done in two ways i.e. studied in different papers published in national & international conferences & journals as well as we have gone through different books and website for water tank cleaning purpose. The details of different mechanism and machine developed have been elaborated below.

Shubham Shrivastav, Hari Om Kumar (2016), Design and Development of Cylindrical Water tank cleaner. 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 adjust according to inside diameter of the tank. When the a.c 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 concludes that overhead water tanks cleaning equipment's was conceived and developed. 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).

Thonge Suraj, Shelke Prasad, Wakte Vaibhav, Thonge Sharad, Prof. Shinde, (2017) explains a mechanical system which clean the tank mechanically using brush, rack and pinion, bar linkage and motor. They claimed that the Cleaning is done more effective than the conventional methods. They also observed that the adjustment of the system inside the tank is difficult.

Ashwin Chander, G. Siddharth, E. Krishna Kanth, Kevein Shadrack, P Vetriverzhan (2019) design and fabrication of water tank cleaning machine. Design and development of machinery for cleaning domestic rectangular water tanks. The system consists of a machine designed with a movable body & an extendable shaft. Mechanism supporting a rotating brush, the movement of shaft & brush scrubs the walls of the tank. Sprinkler mechanism rinses 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.

Mahadev Chavan, Dr. R. J. Patil, Prof. Pankaj Bhokare, Vol. 15, Issue No. 9, October-2018, Design of Automatic Water Tank Cleaning: Machine using Catia Software. The water tank cleaner is used to clean the water tanks by using rotating brushes. This method was cautious than the conventional methods. It is also found that the mechanism is small but the supporting construction which is holding the mechanism is very large that's why, the whole assembly is very big in size.

Yogesh kumar S R, Naveen Kumar R A, Gowtham Naik T, Venkatesh A, Hanumantharaya R U G Student, Assistant professor, volume 11, issue 6, june-2020, Fabrication of water tank cleaning machine. The water tank cleaner is used to clean the water tanks by using rotating brushes. For cleaning, there is a water nozzle this used to spray water or soap water to the inner walls of the tank, but there is not any system to pump out the dirty water.

Despite the advances in robotics and its wide spreading applications, interior tank cleaning has shared little in research activities. When cleaning workers and robots are properly integrated in cleaning tasks, the whole cleaning process can be better managed and savings in human labor and timing are obtained as a consequence. The primary aim of the project is to design, develop and implement an automated overhead tank cleaner which helps to achieve low cost cleaning equipment.

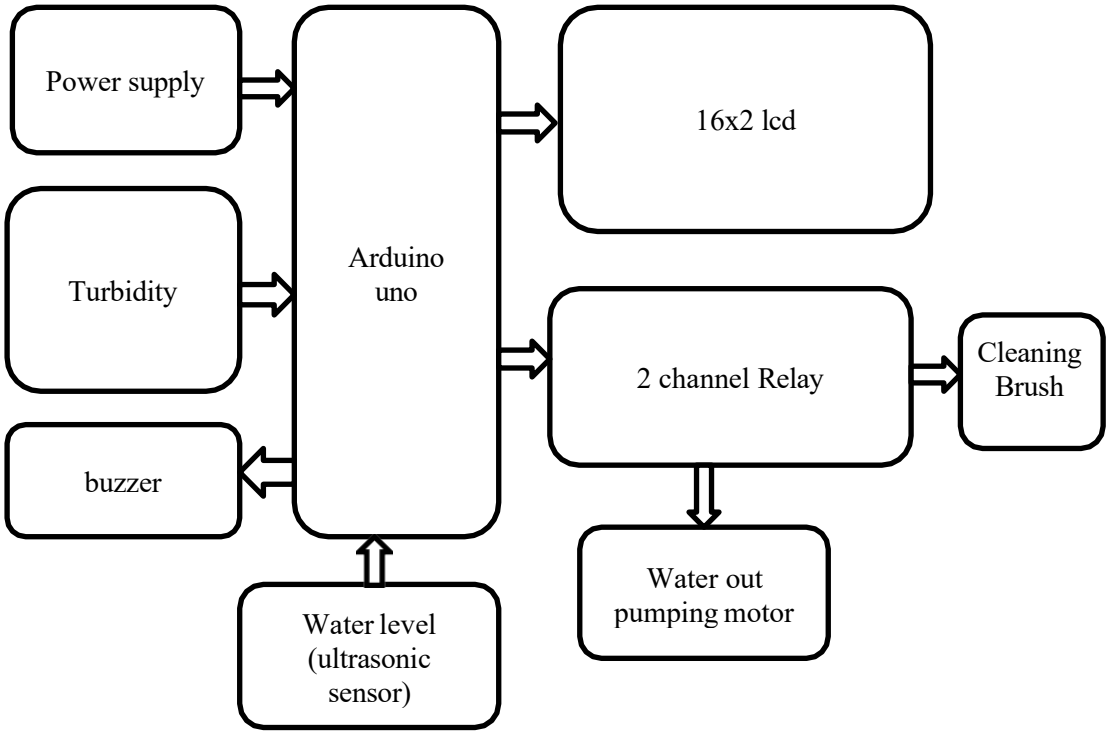
In addition, it would offer the opportunity to reduce or eliminate human exposure to difficult and hazardous environments, which would solve most of the problems connected with safety when many activities occur at the same time. These factors motivate the development of a user controlled robotic cleaning system.

This project is developed for the users to control a cleaning robot automatically by sensing the foul smell in the tank. The main modules in this project are gas sensor, DC motor, Controlling circuit, mechanical frame works and cleaning brush.

The mechanical transmission section can be designed with DC motors or stepper motors, depending up on the load suitable motors can be selected. In some applications, these types of machines are controlled through remote in hazardous places, for these kinds of machines heavy duty motors are essential. Here instead of using stepper motors, high speed reduction gear mechanized DC motors can be used, the advantage of using these types of motors

3- DESIGN

BLOCK DIAGRAM



HARDWARE COMPONENTS

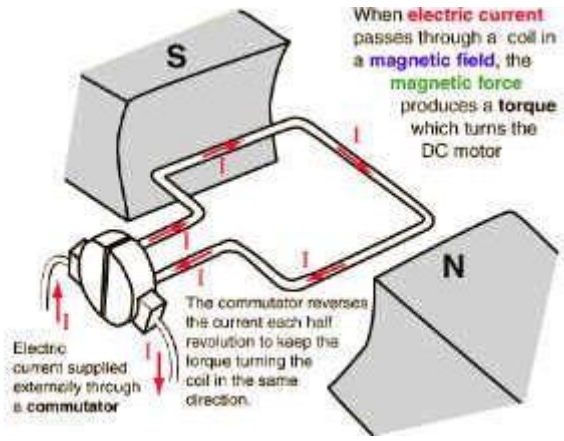
3.1 TURBIDITY SENSOR:

A turbidity sensor is a device used to measure the cloudiness or haziness of a fluid, typically water, which is caused by suspended solids. These particles scatter and absorb light rather than letting it pass through in a straight line. The sensor works by emitting a light beam, usually from an LED or laser, into the water. A photodetector measures the amount of light that is scattered at a particular angle (often 90 degrees) or the amount of light transmitted through the sample. The more suspended particles present, the higher the turbidity and the less light is detected.

Turbidity sensors are widely used in environmental monitoring, wastewater treatment, aquariums, and drinking water systems. High turbidity levels may indicate the presence of contaminants such as silt, microorganisms, or industrial waste, which can affect water quality and ecosystem health. The readings from turbidity sensors are usually expressed in Nephelometric Turbidity Units (NTU). Accurate turbidity measurement is essential for ensuring water safety and meeting regulatory standards. In automated systems, turbidity sensors allow real-time monitoring and control, helping to detect pollution events quickly. Compact and affordable versions of these sensors are now also popular in DIY environmental science projects and academic research.

DC MOTOR:

A DC motor is designed to run on DC electric power. Two examples of pure DC designs are Michael Faraday's homopolar motor (which is uncommon), and the ball bearin motor, which is (so far) a novelty.



RELAYS:

A relay is an electrical switch that opens and closes under the control of another electrical circuit. In the original form, the switch is operated by an electromagnet to open or close one or many sets of contacts. A relay is able to control an output circuit of higher power than the input circuit, it can be considered to be, in a broad sense, a form of an electrical amplifier.

Relays are usually SPDT (single pole double through switch) or DPDT (double pole double through switch) but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are available.

By far the most common DC motor types are the brushed and brushless types, which use internal and external commutation respectively to create an oscillating AC current from the DC source -- so they are not purely DC machines in a strict sense.

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. It comes complete with ultrasonic transmitter and receiver modules

BUZZER:

Buzzer

Objectives:

- Introduce the two main buzzer technologies and their working principles.
- Introduce the two major circuit types and their working principles.
- Introduce various options among CUI's buzzer line, including available sound effects and mounting types.
- Define common specifications.
- Introduce typical applications.

Buzzers are typically used for identification and alarm purposes across many major industries.
Industries Served

- Safety and Security
- Automotive Electronics
- Office Automation
- Medical Equipment
- Industrial
- Consumer Electronics

WATER PUMP:

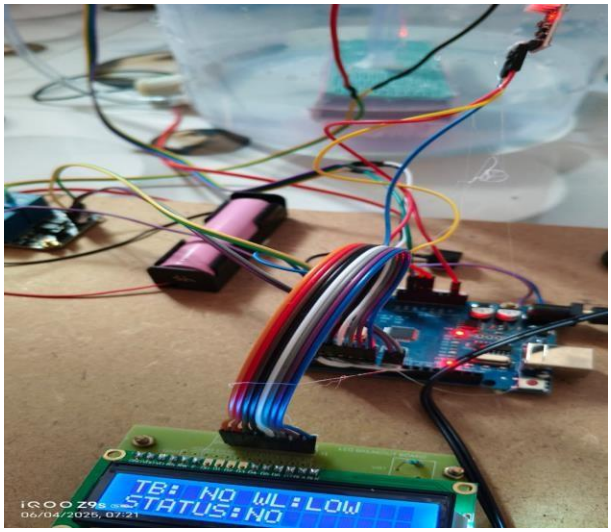
Water pump

This DC 12V submersible water pump is 10.83 x 7.1

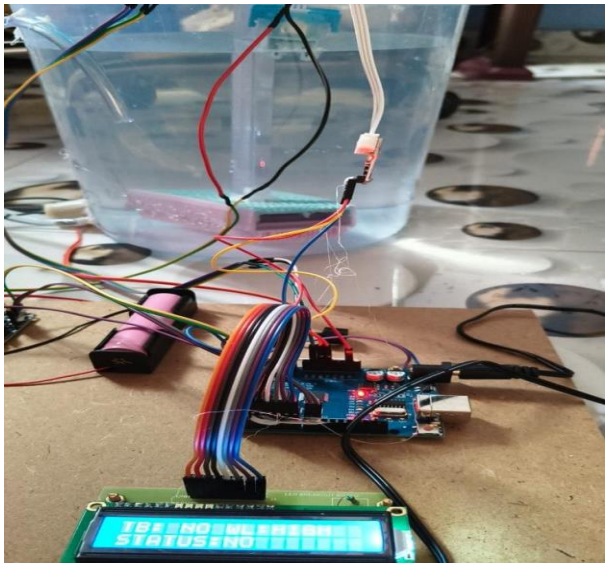
x 7.1 inches in size, with a voltage of 12V and power of 125W. It can pump water up to 26 feet in height at a flow rate of 100L/min and has a 1inch outlet diameter. The pump uses a stainless steel DC electric motor and has protective devices and waterproof seals to pump water from sources like ships or for irrigation applications.

4- RESULTS

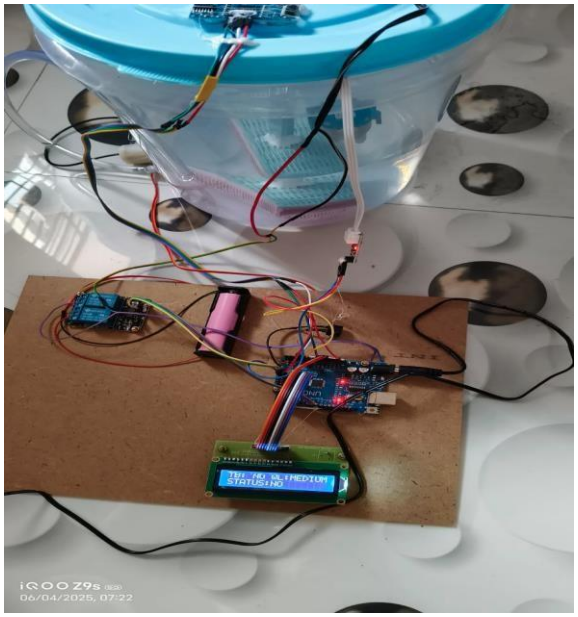
Case-1: Water at low level but there is no indication from turbidity sensor



Case-2: Water at high level there is no status from turbidity sensor



Case-3: Water at medium level there is no status from turbidity sensor



5- CONCLUSION

The project work is designed and developed successfully. For the demonstration purpose, a prototype module is constructed; and the results are found to be satisfactory. Since it is a prototype module, a simple cleaning machine is constructed, which can be used for many applications. In future this can be implemented for controlling the cleaning brush through a remote control as well.

The water tank cleaner is used to clean the water tanks by using rotating brushes. This method is more effective and safer than the conventional methods. This method is capable to clean water tanks within less time and human efforts advanced model of 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.

REFERENCES

The following are the references made during the development of this project work.

1) 1. Akshay Sawansukha, 2. Aniket Humane, 3. Himanshu Bhute, 4.Prajwal Fating, 5.PriyaBobhate, 6.Sandip Raghorte, 7.Dr.V.G Arajpure. "Intelligent Based Design And Development of Overhead Water Tank Cleaning Machine" (2021)[1]

2) Anirudh Ramachandran, Aravind Iyer, Shabharish Iyer, Vineet Mudaliyar, Siddique Ahmed. Design and Fabrication of Automatic Water Tank Cleaning Machine. (2021)[2]

3) Ms. Anuradha Gajanan Jathar , Mr. Kiran Ashok Nikam , Mr. Vaibhav Haribhau Shedage, Mr. Somnath Balu Ghutukade, Mr. Prathemesh Jagganath Chavan , Design And Development Of Smart Water Tank Cleaning Machine. (2023)[3]