TEST Engineering & Management

January - February 2020
ISSN: 0193 - 4120 Page No. 11115 - 11122

IoT Based Water Purification Process using Ultrasonic Aquatic Sound Waves.

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Article Info
Volume 82
Page Number: 11115 - 11122
Publication Issue:
January-February 2020

Article History
Article Received*: 18 May 2019*
Revised*: 14 July 2019*
Accepted*: 22 December 2019*
Publication*: 21 February 2020*

Abstract

In modern human life has created a lot of innovations and it has improved drastically in advance Technology . whenever lot of innovations and advancement in technology will creates a pollution to natural resources like air, water , soil etc. tradional methods such as biological process ,sand filtration ,carbon absorption ,chorine filteration will produce bi-products and creates many serious issues like cancer. In our proposed method Dust particles , micro scopic organisms such as virus bacteria waste particles by using the pre programmed IOT based microcontroller electronic timing control circuit , based on the different period time duration it will generate the different ultrasonic sound Aquatic wave frequency with respect to the time interval it generates the different vibration level inside the water. The filter water will be present in the upper part and the all the ultra sonic biological microscopic particles will settle down at the bottom layer outlet and then it will separated from the water. The proposed method of microscopic ultrasonic sound wave filter will filter all the dust particles.

I. INTRODUCTION

In day to day life every human being will consume a minimum six liters of pure drinking Water to sustain have a good life. Human beings cannot live without four primary things food, water, land and pure air. Therefore, purity of water is importance for human beings. Microscopic Pollutants and minute sand particles present in the membrane surface of the ground water pollutants will lead to a global Problem.

This problem creates a severe and dangerous health problem due to increase in industry

January - February 2020
ISSN: 0193 - 4120 Page No. 11115 - 11122

activities consumer products and many dying industries. On the other hand, living life style of modern humans are drastically improved due to tremendous growth of innovations and advancements in technology , these creates a demand and great challenge to create a clean water at a time when it becomes more polluted.

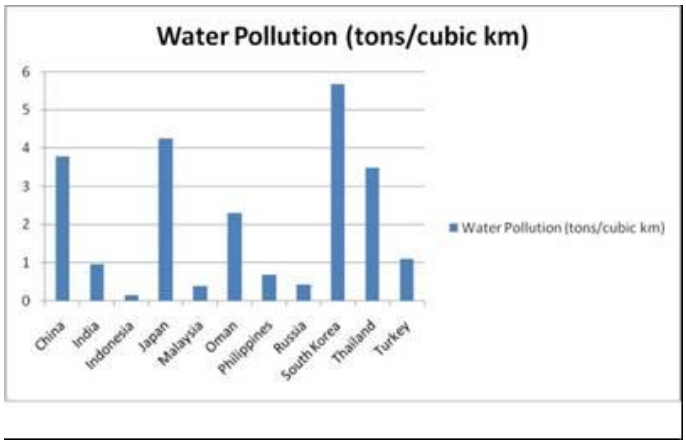
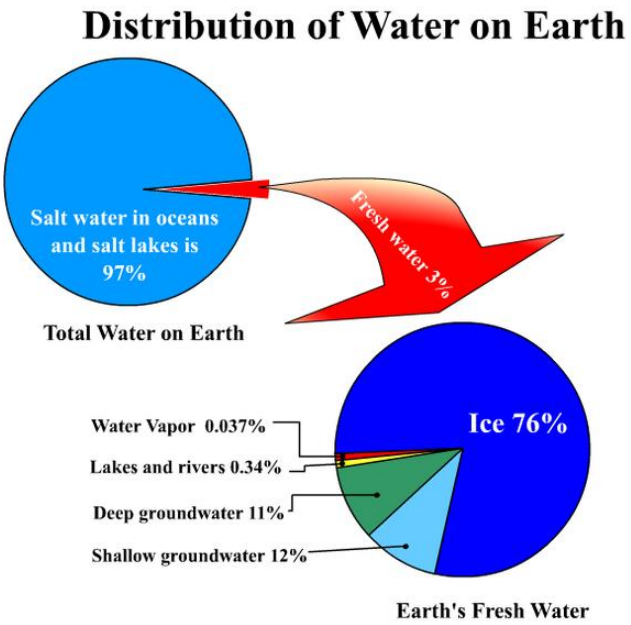


Figure 1. represents the bar chart view of water pollution in cubic per kM

Traditional methods such as sand filter, biological process of cleaning water such using chlorine, Activated carbon water absorption process, purification of drinking water use pretreatment, coagulation/flocculation, clarification, biological treatment, sand filtration, activated carbon adsorption, and ultraviolet and chlorine disinfection. This biological process of filtering the water will not remove completely the micro pollutants and organisms' present in the water. These methods are not very effective for removing micro pollutants such as harmful organics. Due to chemical cleaning processing they will use chlorine related chemicals to add in the water for purification, these method will clean the pollutants but it will change the taste of drinking water. This method of cleaning will cause a serious disease like cancers to humans.nowdays human safety is becoming a big issue to the clean drinking water in major cities. The current method of cleaning water process has undergone through a deep treatment of water even though some parts of micro pollutants present in the water.



Limitations in existing Method :

Drawbacks of chemical process

- It creates a logistic problem during transportation from one place to another
- Cost of price will become more for transporting ,handling & disposing the chemicals from one to another espcailly for military Applications
- It change the natural flavor of taste and smell of water
- It reduces the use of adding chemicals in water such as chlorine and it produces the caranogenic bi-products and it is harmful to human beings and it creates diseases like cancer.

January - February 2020
ISSN: 0193 - 4120 Page No. 11115 - 11122

Block Diagram of proposed method :

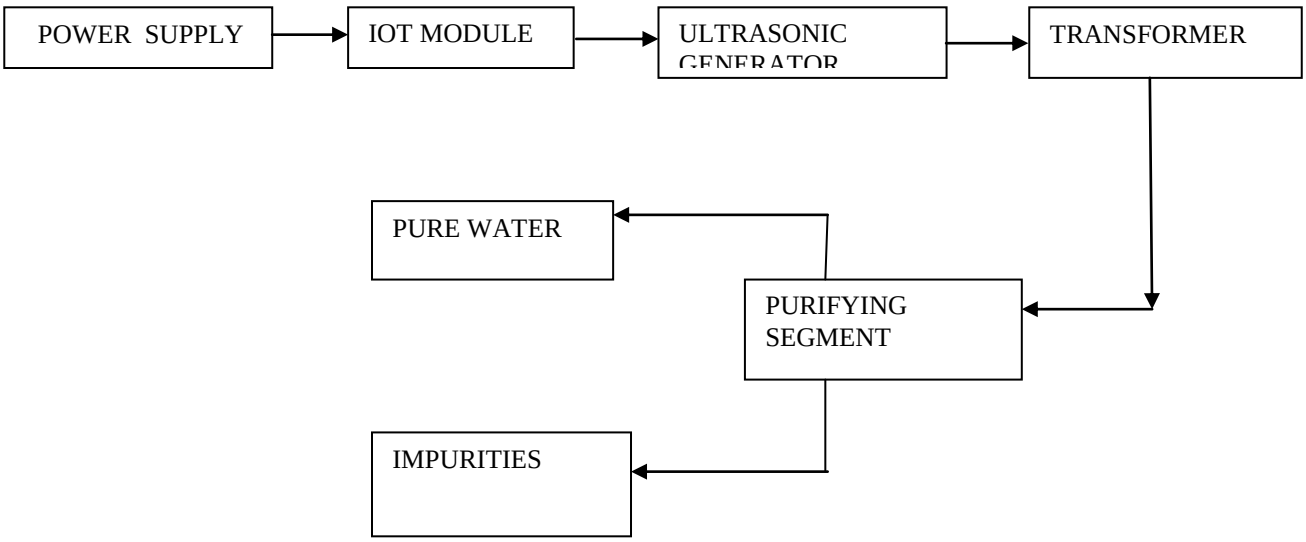


Figure 2. Block Diagram

Power Supply:

The direct 220 volt, 50 Hz AC supply is given to the step up and step down transformer. The output of the transformer voltage is given as the input to the transducer. The transformer voltage is controlled by the pre-programmed IOT microcontroller. The step up transformer is used to increase the voltage by +17.5 Volts based on the time duration selected by the IOT microcontroller. The step down transformer is used to decrease the voltage by 7.5Volts based on the preprogrammed IOT microcontroller. So the alternate power supply is given as input to the Transducer.

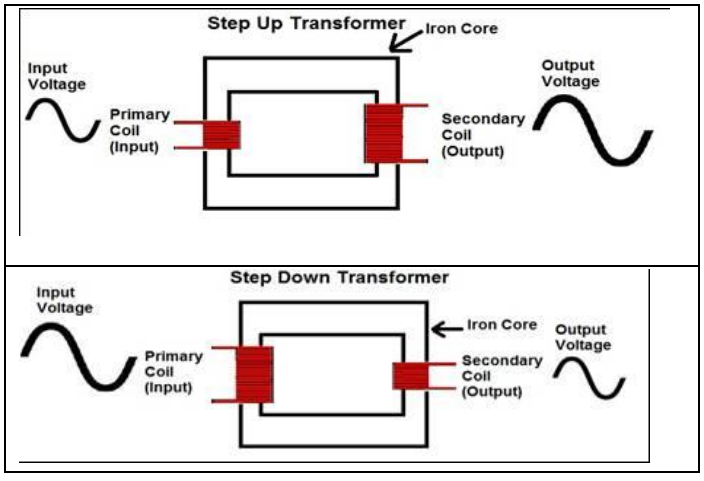


Figure 3 StepUp and step down transformer

IOT Microntroller:

IOT microcontroller is pre programmed to filter the contained water, dust particles, bacteria, virus, micro pollutants, micro organisms using the auto programmed electronic timer control circuit. The Electronic timer circuit is used to select the options to filter the pollutants present in the water based on the timing duration. When time t=0.5µs (it will filter the micro – pollutants). T=0.2µs it will filter the micro organisms. When t= 1.2µs it will filter the dust particles based on the preprogrammed timing duration it passes the voltage as an input to the transducer.

Transducer

Transducer is used to convert physical quantity into electronic signals . In our proposed system we placed (PZT) transducer in the middle of the transducer. It works on the principle of piezo electric effect . From the transformer the power supply is passed to transducer. Based on the potential difference it converts voltage to frequency ranges from hertz to Giga Hertz range.

TEST Engineering & Management

January - February 2020
ISSN: 0193 - 4120 Page No. 11115 - 11122

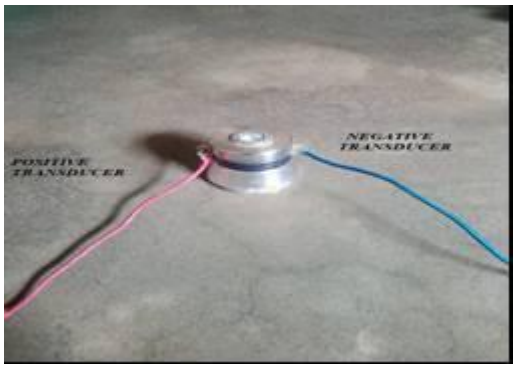


Figure 4. cross section view of transducer

PZT –piezo electric effect principle:-

PZT working principle is based on the piezo electric effect similar to crystal oscillator ckt. This PZT will develop a potential difference across the two ends. Based on the preprogrammed IOT microcontroller operation it selects the timer ckt to give turn on the power supply(i.e one output voltage of step up is connected as a input to transducer and another output from step down transformer output voltage is connected as a input to another end of transducer

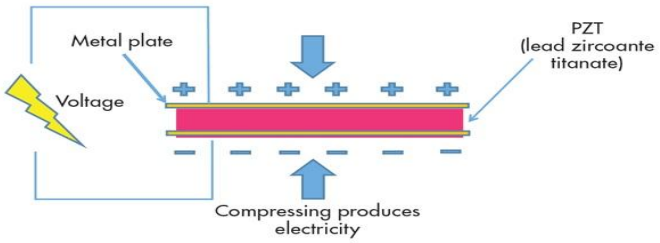


Figure 5. piezo electric principle

Properties of PZT:

- Inverse piezo electric effect technique is used to produce the aquatic ultrasound waves.
- PZT is a ceramic substance created by humans it produces piezo electric effect better than quartz crystal.
- PZT is known as Lead zirconate titanate material.
- It produces more voltage when it is subjected to mechanical stress.
- PZT is produced under high temperature combined with lead and zirconium chemicals and with chemical compounds as titanate.

The chemical formula is given as **(Pb[Zr(x)Ti(1-x)]O3)**

- It is used to produce aquatic waves, electronic capacitor, electronic sensors and transducer.
- It uses inverse piezoelectric device to generate sound waves.

Drawbacks of PZT Transducer

- In large scale water processing the cost of material will be high
- It requires more energy to clean the ultrasonic sound cleaner

Ultrasonic generator:-

The electronic frequency is passed to the ultrasonic sound wave generator, based on the frequency range (1hertz to Gigahertz) generates the ultrasonic sound waves. The sound waves is passed inside the water. Based on the different frequency range it produces the constant aquatic vibration inside the water.

Advantages of ultrasonic membrane cleaning process

- Ultrasound is effective for membrane cleaning
- Ultrasonic membranes are cleaned automatically while they are in use.
- It does not use any chemicals to clean the water and it wont change the taste &smell of water.
- Physical filter medium is not required for this proposed method

Properties of sound waves

January - February 2020
ISSN: 0193 - 4120 Page No. 11115 - 11122

- It produces constant vibrations inside the low viscosity liquids
- The aquatic sound waves are reflected and refracted like light waves inside the water
- Ultra sonic aquatic sound waves are energetic waves
- Ultra sonic sound waves can even melt the certain metals and plastic components present inside the water.
- It produces the constant vibrations inside the low viscosity water.

Drawbacks of ultrasonic process

- In large scale process the cost of transducer will be high
- Diceing cermanics is to be too expensive for the transducer.
- Acquastic impedance will mismatch in large scale water treatment process

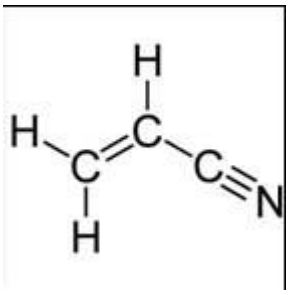
Thermoplastic Fibre Material compound:-

Monomer is a molecule that can be reacted together with other monomer molecules to form a large polymer chain or three dimensional network in a process called polymerization. Thermo plastic fibres are synthetic fiber it has good in wet condition it produces a good elongation. So for that purpose only the inside cylindrical body is made up of Acrylic fiber to produce constant vibration inside the water medium.

Cylindrical Glass tube:

The cylindrical glass tube is made up of thermo plastic polymer.85 percentage composition material consist of acrylonitrile monomer. The physical bonding structure of the acrylic fibre has three dimensional polymer monomer network chain combined with other monometer molecule. The Acrylic momer polymer fiber material which produces a constant sound wave vibration inside the water with respect to electronic frequency.

CH_2CHCN



Working principle

In (PZT) ceramic substance the potential voltage is applied as input and it creates a mechanical stress and it generates constant frequency. The constant frequency is passed to ultrasonic sound wave generator to generate the aquatic sound waves.

These aquatic sound waves will generate the constant vibration inside the acrylic cylindrical water medium made up of acrylic fiber. These material will supports to produces a constant Aquatic sound vibration waves to pass inside the water, it makes the micro pollutants, micro organisms to be settle down at the bottom. Based on the pre-programmed IOT based microcontroller timing control circuit. it generates the different frequency varies from hertz to giga hertz range these frequency will be used to generate the ultrasonic aquatic sound waves. And these waves will create a constant vibration inside the water , due to this constant vibration it makes all the dust particles , micro pollutants and micro organisms to die and t will separated and all those waste , dust particles will deposited under the water and it will be collected by water outlet . Purified water will be collected by separate water outlet.

TEST Engineering & Management

January - February 2020
ISSN: 0193 - 4120 Page No. 11115 - 11122

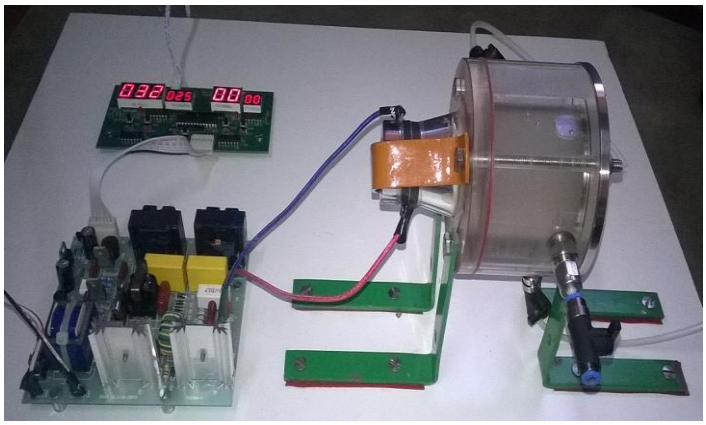


Figure 6. Hardware Implementation

Conclusion

The proposed method shows that in a small scale water purification purpose. It will be very useful when compare to the tradional methods. The aquatic ultra sonic sound waves will produce constant vibration with respect to pre programmed IOT microcontroller it makes the micro pollutants biological substance dust particles to be separated and it will be collected in a separate outlet of the cylindrical tube. The proposed method shows that it is very secure in water purification process without adding any chemicals to purify the water. In this proposed method it does not require any chemicals, heating and boiling process . it working principle based only on ultrasonic sound vibration. It can be implemented in small scale water purification process

REFERENCES

[1] Arokiaraj, D., 2015. A Study on Environmental Responsibility of the Stakeholders of Auto Industry in Chennai (Doctoral dissertation).http://dspace.pondiuni.edu.in/xmlui/bitstream/handle/1/2040/T5889.pdf?sequence=1

[2] Arokiaraj, D., & Banumathi, M. A Study on the Environmental Concern of the Passenger Car User in Chennai. http://irjbm.org/irjbm2013/April2015/Paper8.pdf

[3] David, A., & Banumathi, M. (2014). A Study on Eco–Driving Behaviour of Passenger Car Users In Chennai.http://www.theinternationaljournal.org/ojs/index.php?journal=tij&page=article&op=view&path%5B%5D=2757

[4] D. Arokiaraj (2012), "Major global issues encountered in automobile advertisement", *International Conference on Synchronizing Management Theories and Business Practices: Challenges ahead* 27th & 29th July 2012 ISBN: 978-93-82338-10-9 pp. 199-203.

[5] D. Arokiaraj, (2011), "The Green Market: The Way to Save the World", *Business Strategies*, ISBN: 978-81-920303-6-4, pp. 41-44.

[6] N.R. Harris, M. Hill, S. Beeby, Y. Shen, N.M. White, J.J. Hawkes, and W .T. Coakley, a silicon microfluidic ultrasonic separator, *sensors, and Actuators* B, 95(2003) 425-435.

[7] Mazidi, M. A., Mazidi, J. G., & Mckinlay, R. D. (2000). The 8051 microcontroller and embedded systems. *New Delhi*. Mimar, T. (2016). *U.S. Patent No. 9,491,420*. Washington, DC: U.S. Patent and Trademark Office.

[8] P. Pratheepkumar, J. Josephine Sharmila & D. Arokiaraj, (2017) "*Towards Mobile Opportunistic in Cloud Computing" Indian Journal of Scientific Research (IJSR)*, ISSN, 0976-2876.

[9] Ravi, S., David, A., & Imaduddin, M. (2018). Controlling & Calibrating Vehicle-Related Issues Using RFID Technology. *International Journal of Mechanical and Production Engineering Research and Development*, *8*(2), 1125-1132.

[10] Ruikar, M. (2013). National statistics of road traffic accidents in India. *Journal of Orthopedics, Traumatology and Rehabilitation*, *6*(1), 1.Sridhar, V., Kaluvala, S. S., Shreela, P., & Reddy, S. S. N. (2012). Standalone secured money transferred from

January - February 2020
ISSN: 0193 - 4120 Page No. 11115 - 11122

account to account using a microcontroller. *International Journal of Advanced Research in Electronics and Communication Engineering*, *1*(5), pp-11.E.B.Bes, Method, and apparatus for separating particles, US Patent 5 (1998) 225, 089

[11] R. Srivel, Mr. Ramanarayan Sankriti Transforming Lead-Free Fuel: Filter less Filtration Process by Using Ultrasonic Waves Volume-8 Issue-11S2, September 2019, ISSN: 2278-3075

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January - February 2020
ISSN: 0193 - 4120 Page No. 11115 - 11122

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