

Automatic Water Pollution Control and Filtration System for Rivers Using IOT

Rohit Diwate

Department of computer Engineering
Sapkal college of engineering
Nashik, India.

Pratiksha Dabhade

Department of computer Engineering
Sapkal college of engineering
Nashik, India

Shraddha Chavan

Department of computer Engineering
Sapkal college of engineering
Nashik, India

Pranali Sangale

Department of computer Engineering
Sapkal college of engineering
Nashik, India

Abstract-: *The commonly used method for testing water quality is to gather samples of water and send to the lab to test and analyze. This method is time consuming and waste of man power. In these system an IOT devices are used which help to manage and analyzes the water parameter to control the water pollution. Sensors placed in the rivers which continuously informs the water parameters values at the current time. This information will be updated on the cloud and using an web page, user can access these water parameter on a Smartphone or on the web page anywhere that is connected to Internet. According to the parameters values of water in the river the filtration pump functioning will be automatically on. The uniqueness of these proposed system is to obtain the water monitoring system with high frequency, high mobility with automated filtration of polluted water without man power.*

Keywords: *Internet of Things, Automatic filtration, Real time sensing, GSM module.*

I. INTRODUCTION

Internet of Things the technology of connecting everything using wireless technology. We can control or monitor anything using the sensors designed for different objects. IoT is the collection of objects, devices, houses and other items embedded with sensors, and network connectivity to enable them to communicate with each other and to send data to the best stations. Internet of Things (IoT) technology is rapidly evolving with the latest innovation which is used in Wireless technology and an embedded technologies. Using Micro controllers working on low powers it defined that are best solution for virtually deployed Internet of Things systems to connect peoples and works for years without any maintenance has made the IoT not only for luxury functions but also for needful data aggregation as for defense systems. The devices participating in IoT are designed to be interoperable with different vendors of embedded controllers as well as with different wireless technologies. IoT is progressing with millions of things connecting each day to generate large amount of information resulting in useful future actions. Wireless sensor networks have limited power resources. To extent network life time switching mode has been assigned to each sensor node .where each node become sleep mode as soon as it transmit the data packet from one end to another end. Most common task of an IoT based applications are transmitting huge sensed data to a specific node. To acquire, process and transmit the sensed data efficiently is a key challenge in the IoT . Wireless sensor networks and RFID (Radio frequency identification) technologies are achieving excellent infrastructure in manufacturing industry to sense as well distribution of data in decentralized environment.

In 21st century, Water pollution is the major problem in front of world, which is nothing but the dirt of water bodies. Water pollution occurs when dirt or chemicals are discharged directly or indirectly into water bodies. Water pollution affects on plants and also human health is affected by polluted water River pollution has been a major problem in the developing countries. Fast industrial growth has led to increase in quantity of chemicals material used in industry, as well as in industrial facilities which use the chemicals as raw materials. As a result of this there is an increased emission of dangerous materials into the air, water and soil. Although water problems occur in specific locations and regions, they are in fact global problems in that their frequency, magnitude, and potential effects are

increasing rapidly. Concerning that water is one of the most important natural resources and one that will determine future prosperity and stability, this proposed system defined the River water pollution control and if that water is polluted that will automatically filtered.

II. LITERATURE SURVEY

Water quality monitoring system represents additional step in IoT. This system effectively helps to monitor the water parameter for its quality analysis at long distance without loss of data to avoid its critical effects on Human beings, Fields, and on Animals. IoT (Internet of Things) provides excellent infrastructure for real time data acquisition with high speed for various sensor data [2], [3]. Waste water issue can overcome by monitoring physical water parameters continuously in a flexible manner with low cost. Based on this cognizance many IEEE papers are surveyed[1]. Qing pong Chi et.al [2] proposed reconfigurable smart interface device to read data parallel in real time with high speed on different sensing elements. It helps to reduce compatible issues for any newly added sensing element to interface device by adopting standard protocol smart transducer interface (STIM). STIM interface standard IEEE1451 enables sensors to discover network automatically based on series of specification given by interface device and perform plug and play operation on each sensor. M. T. Lazarescu [3] described reusable WSN (wireless sensor network) flat form for low cost long term monitoring applications. This system helps to improve ad hoc changes on sensor node with onboard processing in terms of its cost, power consumption, reusability, productivity and maintaining of sensor nodes. F.Salvadori et.al.[4] presented dynamic power management with scheduled switching mode(DPM-SSM) protocol to extend network life time in industrial monitoring systems. It helps to extend a network life time effectively by switching the node to a sleep mode (just 1ms) as soon as it transmits the data packet. The system with DPM-SSM protocol takes full advantages by transmitting one-third of more packets than system without DPM-SSM.

S. Li, L. Da Xu, and X. Wang [5] applied compress sensing (CS) theory to avoid redundant data in WSN's and IoT. CS framework helps to data compressed sampling, robust the transmission, accurately rearranging data to reduce energy requirement, increasing network life time, and data redundancy. Li Wang et.al [6] presented five layer system architecture to integrated WSN and RFID technologies for interactive action in manufacturing atmosphere. Where data cleaning algorithm has been stated to prevent redundant data, which occurs due to duplicate reading and due to time delay between each sensor nodes. Hence this algorithm dynamically helps to boost the speed of performance in sensor network as well as reduce time delay between each nodes infarction. Brief survey of previous work reveals that the information propagation is significantly promoted for understanding the emerging technologies with a standard communication protocol for various applications using IoT environment. The implemented system is very simple, flexible, and cost effective method for water quality monitoring system over traditional water quality analysis. System contains Microcontroller unit for controlling and preprocessing task at base station, at monitoring station data can be access by IP address on Web page for worldwide monitoring. Shruti Sridharan et al. [7] addressed in their project about developing an efficient wireless sensor network (WSN)based water quality monitoring system, that examines water quality, an important factor as far as, irrigation, domestic purposes, industries, etc are concerned. R.Karthik Kumar et al.[8] investigated Underwater wireless sensor network to monitor the quality of water using wireless sensor network (WSN) technology powered by solar panel. Through Wireless Sensor Network various data collected by various sensors at the node side such as pH, Turbidity and oxygen level are sent to base station. At the base station collected data is displayed as visual and is analyzed using different simulation tools.

Marco Zennaro, Athanasios Floros, GokhanDogan, Tao Sun, Zhichao Cao, Chen Huang, ManzoorBahader, Herve' Ntareme et al.[9] proposed the design of a water quality monitoring system and, building upon the SunSPOT technology, a prototype implementation of a water quality wireless sensor network(WQWSN) as a solution to the water quality monitoring problem. Daudi S. Simbeye and Shi Feng Yang [10] provided the design of water quality monitoring and control system for aquaculture based on wireless sensor networks and single chip computer technology as a base in the actual operation. It realizes the monitoring of the water environmental parameters for intensive aquaculture and alarm notification through short message when monitored variables take anomalous values and is suitable for long-term stability under growth conditions thus increasing yield per unit area. Kirankumar G.Sutar, Prof.Ramesh T.Patil[11] presented the fish farm monitoring system based on wireless sensor network. The system is constituted by a base station and sensor nodes. The sensed parameters with their exact precision values are transmitted to the base/monitoring station through wireless communication and details are monitored by the administrator. When any of the parameter is found to be above a threshold value an indicator will indicate it. The system has advantages such as low power consumption, more flexible to deploy. C.Khetre, Prof.S.G.Hate [12] investigated and defined a wireless sensor network for water environment monitoring system. It provides a useful feature's such as large monitoring ranges, low cost, low power consumption, flexible configuration and very small damage to the natural environment. The system successfully provides online real time monitoring of the temperature, turbidity, water level, and salinity. Zhu Wang Qi Wang, Xiaoqiang Hao [13] discussed the problem of the manual analytical method adopted in water quality detection with bad real-time character and introduced a novel kind of remote water quality measuring and monitoring system based on WSN. Zulhani Rasin and Mohd Rizal Abdullah [14] proposed implementation of high power Zigbee based WSN for water quality monitoring system with low power consumption and high reliability presented. The use of high power WSN is suitable for activities in industries involving large area monitoring such as manufacturing, constructing, mining.

Geethanjali.S, Mekala.M,Deepik [15] presented a narrative water eminence monitoring organization Zigbee based on wireless sensor network contributing small power utilization with high reliability. Peng jiang and Hongboxia [16] have proposed the Design of water environment system based on wireless sensor network. This system takes MSP430F1611 processor to develop automatic water environment monitoring system. O'Flynn,B,Martinez-Catala [17] have developed automated water environment monitoring system using GSM technology, this system sends the online measurement of water parameters directly on mobile phone through GSM technology. Mingfie Zhang, Daolaing Li [18] presents a system framework taking the advantages of the WSN for the real-time monitoring on the water quality. They design the structure of the wireless sensor network to collect and continuously transmit data to the monitoring software then accomplish the configuration model in the software that enhances the reuse and facility of the monitoring project. This monitoring system has been realization of the digital, intelligent, and effectively ensures the quality of aquaculture water.

III. PROPOSED SYSTEM

The main aim of this propose system to overcome the problem of manual filtration of water. In this proposed system the filtration of water is automated at remote places using wireless sensor networks, micro controller and high accuracy. pH, conductivity, turbidity level, etc are the parameters that are analyzed to improve the water quality. Following are the objectives of idea implementation :

To measure water parameters such as pH, temperature , turbidity, salinity and industrial chemicals or the oils which are wasted in river etc by using available sensors at remote place.

- To collect data from the given sensors and send it to base station and the server(data base) or Health department or water pollution control/monitoring department by GSM module.
- To analyze quality parameters for quality control.
- To send notification to an authorized person automatically when water quality is degraded and it does not match the given standards. So that, the purification or the filtration of polluted water automatically turn on by micro-controller.
- The detailed block diagram of automatic water quality monitoring and filtration is shown in Fig 1.

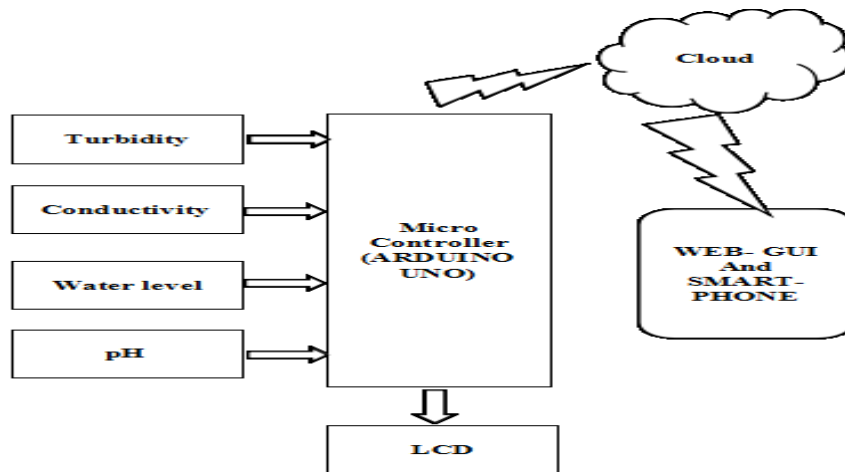


Fig 1.: Block Diagram of system

1. heated for 24 hours. This means that Compressive Strength to Self Weight ratio for 48 hours is more than 24 hours.
2. Further it is also observed that compressive strength of cubes after 7 days is slightly more than those at 3 days. This means that more the rest period more will be the strength.

IV. IOT FRAMEWORK FOR SYSTEM

In this system need to take data from various kinds of meters used in water resource engineering with the help of sensors which is placed with meters and valves at known spatial locations. These sensors stores the data on cloud using GSM module. We can use different types of network connection as per the usage and data size. If the data is small as in numbers we can use 2G connection. But if data is large as pictorial data we need to use 3G or 4G connection. We can also set a Wifi network over the system for smooth running of the system. Now these data from different sensors received by the server and store it to the geo databases and further preprocess the data. Analysis part can be start when the data preprocessing ends. Analysis can be done on the basis of temporal observations. Now analyzed data is used to take decision at decision support system. And decision based input is sent to the valves or meters.

We collect the location based data from different sensor locations. At the time of placing sensor with valve/meter we must have to take GPS point of that particular point for tracking and up gradation on Web- GUI. Here we are collecting data of sensor 1 to N for analysis purpose of any area of water supply or monitoring system.

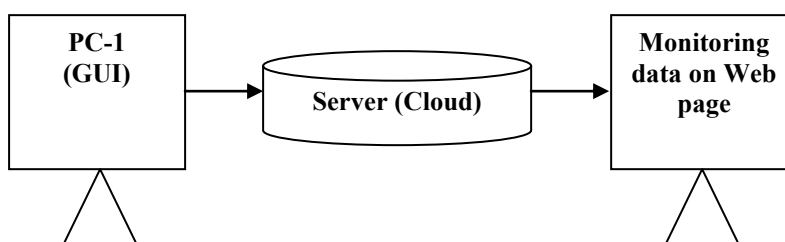


Fig 1.: Monitoring Department Unit.

V. SCHEMATIC CIRCUIT DIAGRAM

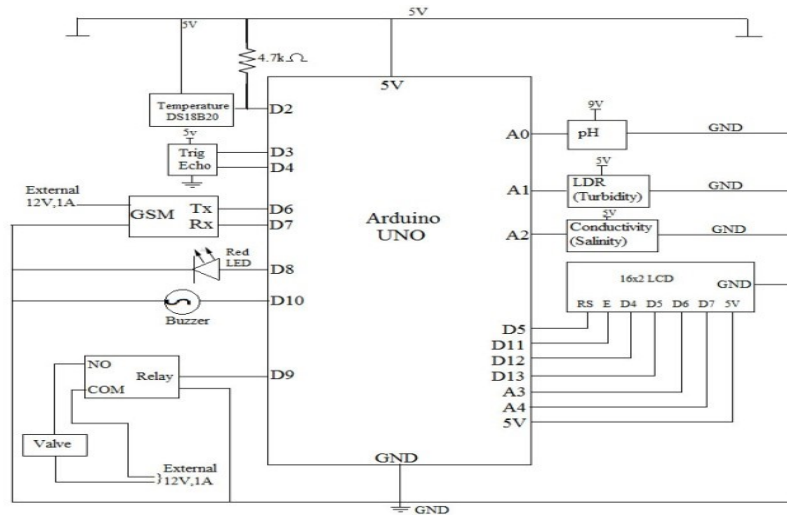


Fig.3 : Circuit Diagram

VI. ADVANTAGES

- Using IOT in water pollution system, we can track the release of harmful chemicals and waste in rivers, thereby arresting water pollution.
- We can also keep tabs on the quality of water being supplied for drinking.
- Due to physical objects getting connected and controlled digitally the with wireless infrastructure there is large amount of automation and control in the working.
- Without human intervention, the machines are able to communicate with each other leading to faster and timely output.
- Provide good quality water to each house and control the water pollution which is harmful to human. The proposed system can be implement as a part of the smart city.

VII. EXPERIMENTAL RESULT

Three water samples from different water sources were tested to establish a reference on the parameters for each water type. The chosen water types were river water, industrial water and Tap water. The three water samples were tested simultaneously with three separate, identical systems at indoor ambient temperature. Readings were taken at 1 hour intervals for a total period of 12 hours. For security reasons the systems were not deployed in the specific areas of interest, instead water samples were collected and tested in a safe controlled environment. However, the tap water sample was changed every hour to see the consistency of tap Water.

A. Reference for tap water

Fig. 4-6 shown the trends of the acquired data and are consistent with the globally accepted values for pH, conductivity . The temperature effect on pH and conductivity is clearly observed.

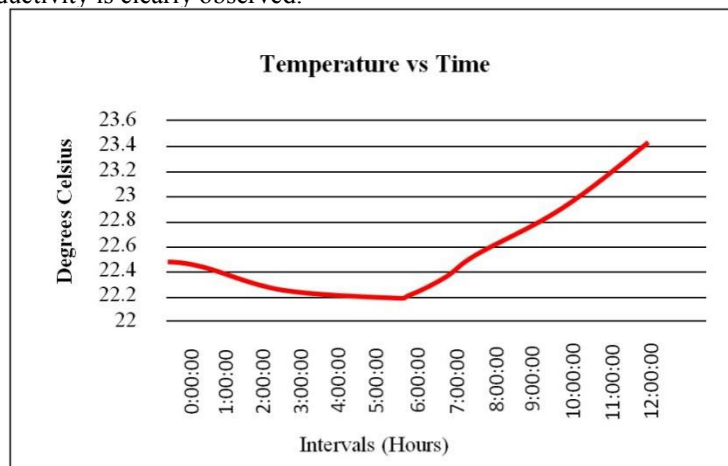


Fig.4 : Graph of the solutions ambient temperature.

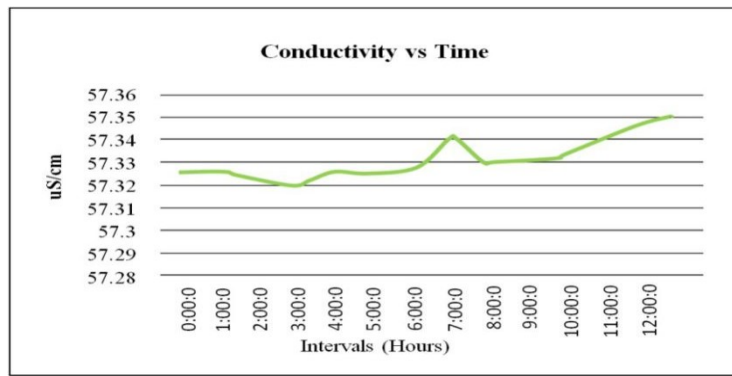


Fig.5 : Conductivity for tap water is shown.

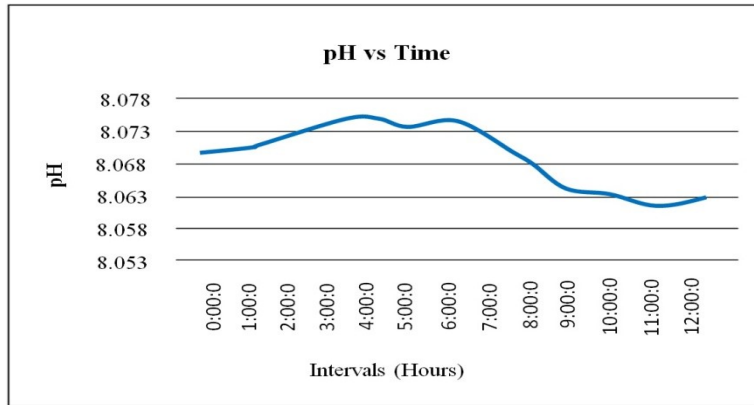


Fig.6 : pH for tap water is shown.

B. Reference on River

A sample of fresh seawater, collected from Ganga river, was tested to provide a reference on healthy river water with little to no contamination.

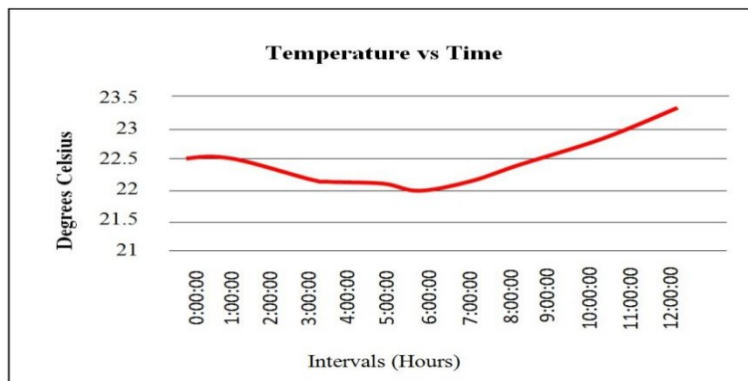


Fig.7 : Temperature trend for river water.

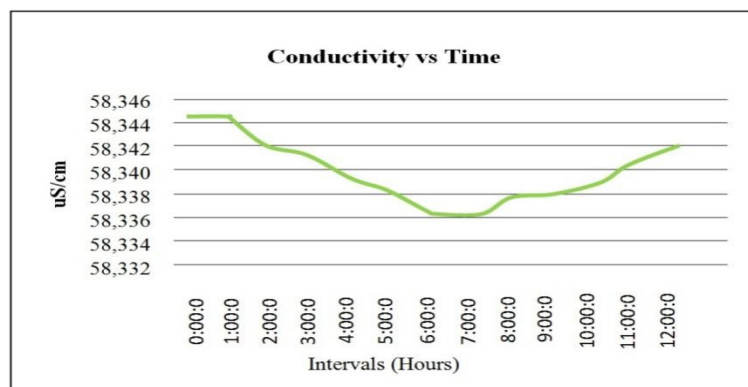


Fig.8 : Conductivity for river water is shown.

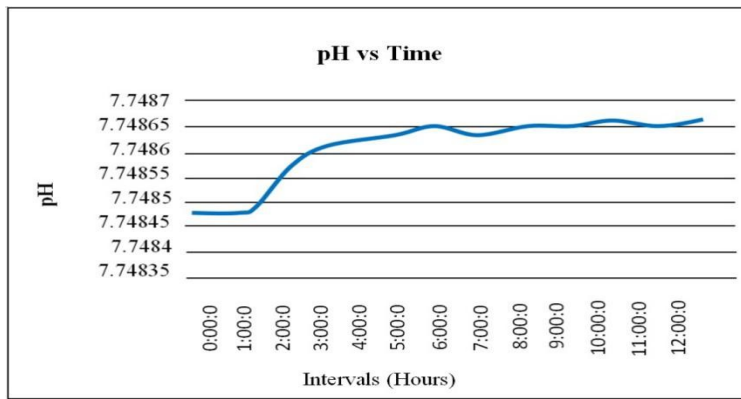


Fig.9 : pH for river water is shown.

The results shown in Fig. 7-9 indicate values that are near to the researched data for acceptable river water parameters that can sustain aquaculture .

C. Reference on Industrial water

To get a fair idea of how the parameters of polluted water should look a sample of water was collected from the industrial chemicals outlet an extremely polluted waterway in the heart of Nashik City. The results are shown in Fig. 10- 12.

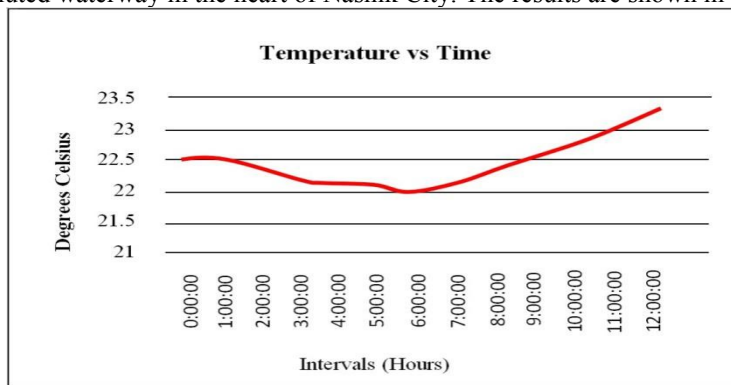


Fig.10 : Temperature trend for industrial water wastage.

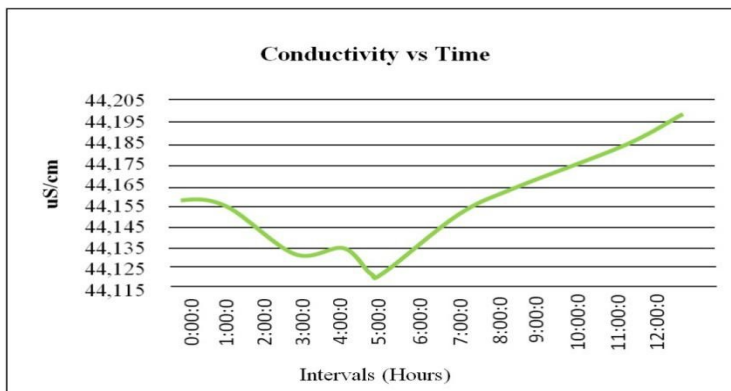


Fig.11 : Conductivity for industrial water wastage

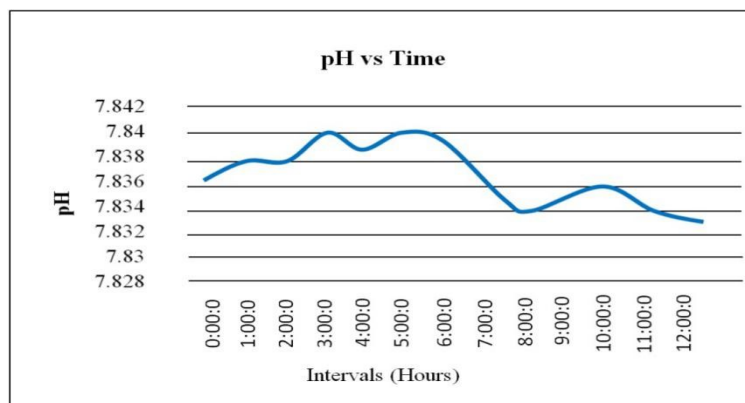


Fig.12 : pH for industrial water wastage is shown.

D. Summary of the tested properties between the water samples:

A comparison can be made with the collected data between tap water, river water, seawater and polluted industrial water. The pH levels for all were fairly similar with the only change being in relation with temperature. Conductivity for the water samples differed significantly because of the different salinity concentrations for different water types. The highest conductivity being 58000 uS/cm for river water and the lowest being that of tap water with conductivity value of 58 uS/cm.

The data obtained for polluted water has some interesting values for conductivity. This is an expected value considering the background of industrial water having waste lines connected to the river. The conductivity value was in the 40000 range indicating that water samples likely contained traces of pollution. A summary is also presented in table format shown in Table I.

TABLE I. SUMMARIZED RESULTS

<i>Source</i>	<i>Readings</i>		
	Temperature	pH	Conductivity
Ganga River	20-30 °C	7.7-8.2 pH	70-80 uS/cm
Tap Water	20-30 °C	7.7-8.1 pH	50-70 uS/cm
Industrial wastage oil	20-30 °C	7.7-7.9 pH	42-45 uS/cm

CONCLUSION

In this system, the model of automatic water pollution monitor with water filtration using Internet of Things technology is presented. The proposed system is created with the use of salinity sensor, turbidity sensor, ph and temperature sensors and some industrial chemicals or oils sensing different sensors, Arduino as controller and Cloud(server) for storing the data from Arduino and sending the command to Arduino for measuring water quality and do filtration of water autonomously. The generated data can be viewed using web interface all over the world to the authenticated department.

REFERENCE

1. Shailaja. M. Gunda Nikkam, "Water Parameter Analysis for Industrial Application using IoT", *IEEE 2nd International Conference on Applied and Theoretical Computing and Communication Technology (iCATccT)*, pp.703 - 707, July 2016
2. Qing ping Chi, Hairong Yan, Chuan Zhang, Zhibo Pang, and Li Da Xu, "A Reconfigurable Smart Sensor Interface for Industrial WSN in IoT Environment ", *IEEE Transactions on Industrial Informatics*, vol. 10, no. 2, pp.1417-1425, May2014.
3. M. T. Lazarescu, "Design of a WSN platform for long-term environmental monitoring for IoT applications ", *IEEE Journal on Emerging and Selected Topics in Circuits and Systems*, vol. 3, No. 1, pp. 45- 55, March 2013.
4. F.Salvadori et.al., "Monitoring in industrial system using wireless sensor network with dynamic power management ", *IEEE Transactions on Instrumentation and Measurement*, vol. 58, no. 9, pp. 3104-3111, September 2009.
5. S. Li, L. Da Xu, and X. Wang, "Compressed sensing signal and data acquisition in wireless sensor networks and internet of things ", *IEEE Transaction on Industrial Informatics*, vol. 9, no. 4, pp. 2177-2186, Nov. 2013.
6. L. Wang, L. D. Xu, Z. Bi, and Y. Xu, "Data cleaning for RFID and WSN integration", *IEEE Transactions on Industrial Informatics*, vol. 10, no. 1, pp. 408-418, February2014.
7. Shruti Sridharan, " Water Quality Monitoring System Using Wireless Sensor Network" - International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Volume 3, Issue 4, April 2014.
8. R.Karthik Kumar, M.Chandra Mohan, S.Vengateshapandiyar, M.Mathan Kumar, R.Eswaran, " Solar based advanced water quality monitoring system using wireless sensor network " - International Journal of Science, Engineering and Technology Research (IJSETR), Volume 3, Issue 3, March 2014 ISSN: 2278 – 7798
9. Daudi S. Simbeye and Shi Feng Yang , "Water Quality Monitoring and Control for Aquaculture Based on Wireless Sensor Networks" - JOURNAL OF NETWORKS, VOL. 9, NO. 4, APRIL 2014
10. Kirankumar G.Sutar , Prof.Ramesh T.Patil , " Wireless Sensor Network System to Monitor The Fish Farm" - Int. Journal of Engineering Research and Applications Vol. 3, Issue 5, Sep-Oct 2013, pp.194-197

11. Zulhani Rasin and Mohd Rizal Abdullah, "Water Quality Monitoring System Using Zigbee Based Wireless Sensor Network "- International Journal of Engineering & Technology IJET -IJENS Vol:09 No:10
12. Geethanjali.S, Mekala.M, Deepik , "Water Eminence Scrutinizing Scheme Based On Zigbee and Wireless Antenna Expertise - A Study "- International Journal of scientific Research in Computer Science Applications and Management Studies - ISSN 2319 – 1953
13. Peng Jiang, Zheming Wang, "Design of water environment monitoring system based on wireless sensor network" - IEEE 2nd International Conference on Industrial and Information Systems, 2010
14. O'Flynn, B, Martinez-Catala, " A wireless sensor Network for water quality monitoring"; 32 nd IEEE Conference on Local computer Networks, 2007, LCN 2007
15. Zhu Wang Qi Wang, Xiaoqiang Hao - "The Design of the Remote Water Quality Monitoring System Based on WSN"-International Journal of Engineering & Technology IJET -IJENS Vol:21 No:11
16. Rasin, Zulhani, Abdullah, Mohd Rizal, " Water Quality Monitoring System Using Zigbee Based Wireless Sensor Network" – International Journal of Engineering & Technology; Dec 2009, Vol. 9 Issue 10, p24.
17. S. D. T. Kelly, N. Suryadevara, and S. C. Mukhopadhyay, "Towards the Implementation of IoT for environmental condition monitoring in homes," IEEE Sensors J., vol. 13, no. 10, pp. 3846–3853, Oct. 2013.
18. Qingping Chi, Hairong Yan, Chuan Zhang, Zhibo Pang, and Li Da Xu, "A Reconfigurable Smart Sensor interface for Industrial WSN in IoT Environment" *IEEE Transactions on Industrial Informatics*, vol. 10, no. 2, May 2014