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SURFACE WATER POLLUTION MONITORING SYSTEM BASED ON IoT

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Abstract

The life of human, animals, and plants is based on the water so that it's very important to protect it. In the last decade, the water important increased rapidly because of many reasons: the high increase in population grew, limited water resources, and pollution. In this paper, we propose a mechanism to protect water resources (rivers or lakes, etc.) by monitoring it in real-time. The monitoring is done by sensors to measure water parameters. All these data will provide to the ministry of environment to help them to take a correct decision that bounded the infection area and prevent the infection to spread to another area. To transmit data from monitoring area to control center we used the internet based on internet of thing (IoT) technology.

Keywords: NodeMcu, IoT, Conductivity sensor, Temperature sensor, Turbidity sensor

Introduction

The water is a very important resource because it's limited and so essential in the agriculture and industry. The health of humans and animals will be affected severely if any change will occur in water quality A. S. Rao, *et al.*, (2013). There were lots of inventions in the 21st century, but at the same time, the populations increased rapidly so that limited safe drinking water for the world's humans Kumar *et al.* (2014).

Animal and human wastes send to rivers and lakes. Furthermore, solid, mineral and chemical residues also send to it. So that the water surface presents a wide range of problems as a big concentration of heavy metals, high turbidity, high temperature, etc. All that cause water pollution Yauri *et al.* (2017).

Collect water samples from different locations manually then test the samples at the laboratory are traditional methods used in the monitoring of water quality. The traditional methods are very time consuming, not efficient and high cost Rao *et al.* (2014).

Diagnosis of pollution sources in real-time need Higher-resolution data that will greatly assist managers in assessing the remediation efforts of pollution. Therefore, today it is very important to build a real-time water monitoring system at an acceptable cost Hadi *et al.* (2017).

This project focuses on reading water parameters in real-time and delivers directly to the IoT server through the internet by using multiple sensors to monitor the parameters such as turbidity, temperature, and conductivity. IoT cloud can be accessed at the monitoring station or from any location through the internet

Pal *et al.* (2017), made an Air Pollution Monitoring System based on IoT to monitor the quality OF air using the internet and will trigger an alarm when the quality of air goes down beyond a certain level that means harmful gases are present in the air. Bhatt *et al.* (2016) water quality monitoring system using IoT that in real-time monitor quality of water was presented. This system have number of sensors to measure the parameter of water (turbidity, conductivity, temperature). Microcontroller collect the data from sensors then transmit to the core controller through Zigbee. Core controller transmits these data to the IoT server. The authors Pappu *et al.* (2017), was developed as a system to monitor the quality of water in storage tanks. This system used the PH sensor and TDS meter. In addition, the algorithm of machine learning has been used for predicting the quality of water-based on the trained data set. Air Pollution Monitoring System has been developed by Sai. (2017). This system measures concentrations of gases such as NO_2, SO_2, CO, and CO_2 using sensors. The raspberry pi acts as a base station that collects data from sensors. Aaina Venkateswaran *et al.* (2017) presented the design and development of a system for monitoring of water quality based on the IoT environment. The system contains a number of sensors which are used for measuring water parameters such as turbidity, pH, temperature, and conductivity. Madhavireddy *et al.* (2018) presents the design of a system for water monitoring in using the internet of things. The system contains a number of sensors. The collected data from the sensors can be processed by the microcontroller. Finally, the sensor data can be shown on the IoT server. IoT server was configured as data saving and analysis. Monitoring of air pollution using the internet of things technology based on machine learning was proposed by Mishra. (2018). Ahmed Sha, *et al.* (2018), presented the design of the internet of things technology in water quality monitoring system. This system contains a number of different sensors which measure the water quality parameter (turbidity, Gas, pH, Level of water). The data from the sensors is processed by microcontroller then transmitted remotely to the base station using IoT technology. Finally, the data can present on internet browser using the cloud. V. V. D. and Gaikwad. (2018), presented a system for water quality monitoring based on IOT. The system has several sensors that used to read water parameters (turbidity, pH, temperature, flow sensor). The sensors data can be processed by the microcontroller. Z.S.F, *et al.* (2019) present a system that can monitor industrial pollution and provide a healthy environment for the workers. The system monitor pollution in real-time and indicates when there is an increase using the Internet of Things technology.

Materials and Methods

The system component

(i) IoT

The internet changed all human life in the past decade. One of the major development is the internet of things (IoT) throughout the internet technologies. IoT is concerned with communicating objects that are located in a different area that is distant from each other. IoT represents a concept in which, devices can sense and collect data from the real world, and then across the internet can share that data where it can be processed and utilized for different purposes. Traditional communication between human is quite different from IoT communication, a large challenge will bringing to existing telecommunication infrastructure. To achieve monitoring real-time the IoT concept is very much helpful in this case Aaina Venkateswaran *et al*. (2018), Croock *et al*. (2017), Ghazi *et al*. (2018), and Shihab Hamad *et al*. (2019).

IoT is a type of network technology, which is based on information sensing equipment. can make anything connect the Internet according to the protocol to exchange information, which gives the location, management, and monitoring Wang *et al*. (2015) and Hamad (2017).

(ii) NodeMCU

NodeMCU is a board for inexpensive projects that using Wi-Fi. It is microcontroller plus Wi-Fi module in the same board. It's so popular in IoT projects. NodeMCU is shown in figure number 1.

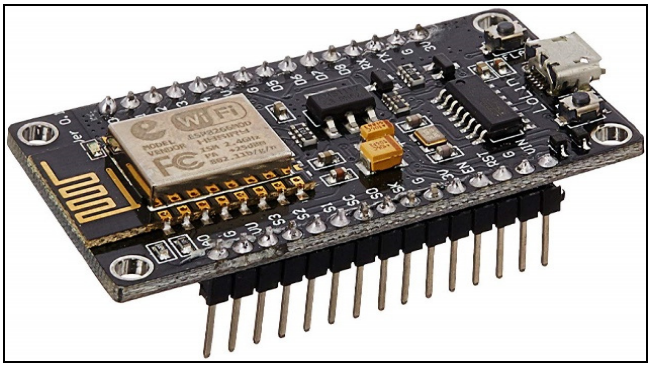


Fig 1: NodeMCU

(iii) Sensor

In proposed project we used three type of sensors

a) Turbidity sensor: the basic concept of a turbidity sensor is measuring the amount of light that is scattered by the suspended solids (TSS) in water. if the TSS is increased that means high turbidity and vice versa. Turbidity sensor is show in figure number 2.

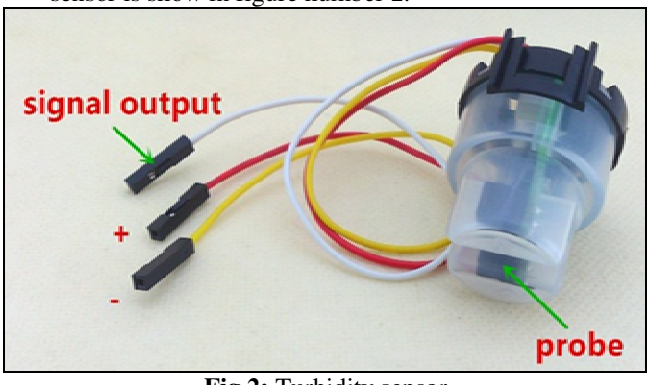


Fig 2: Turbidity sensor

b) Temperature sensor: to decide how water is hot or cold we use Water Temperature. The range of DS18B20 is from -55 to +125 °C. This sensor is a digital which gives an accurate reading. Temperature sensor is shown in figure number 3.

Fig 3: Temperature sensor

c) Conductivity sensor: this sensor measures the ability of a liquid to conduct an electrical current. Presence of ions in a liquid allows it to be conductive. The greater level of ions means greater conductivity and vice versa. Conductivity sensor is shown in figure number 4.

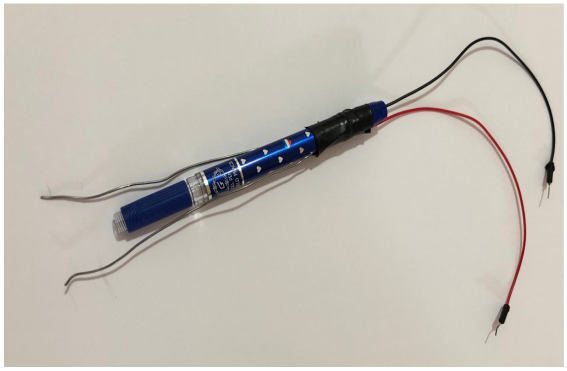


Fig 4: Conductivity sensor

Results and Discussion

Designed Monitoring System

Figure number 5 presents the proposed system. The system contains a number of sensing node these nodes spreading at the covered area to monitoring it and send data to the server through internet.

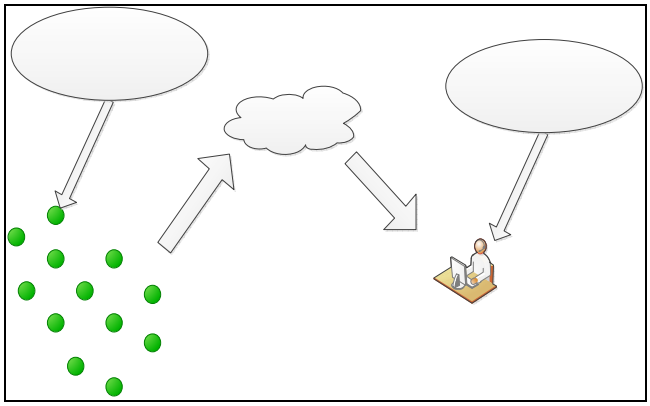


Fig 5: the proposed system

The proposed system contain three main parts:

1. Sensing node: the system has large number of sensing node, each of them its work independently and contain power supply and sensors (Turbidity, temperature, conductivity) and control and send the collected data from sensor through Wi-Fi module. As shown in figure number 6.

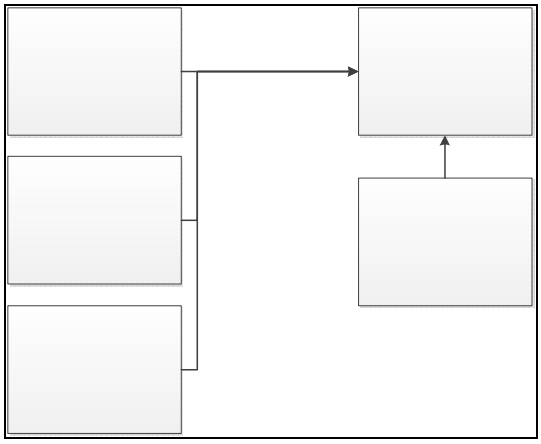


Fig 6: Sensing node

2. IoT server: its cloud server used to receive data from the sensing node then present it in a meaningful way (flowchart, figure, etc.) to ease understand it.in this project we use Ubidotes as IoT server the dashboard is presents digital information from our physical world into a simply understood display on a computer or mobile device. To create new IoT server you must press the button (GET STARTED) as shown below in figure number 7.

Fig 7: shown step one when used ubidotes

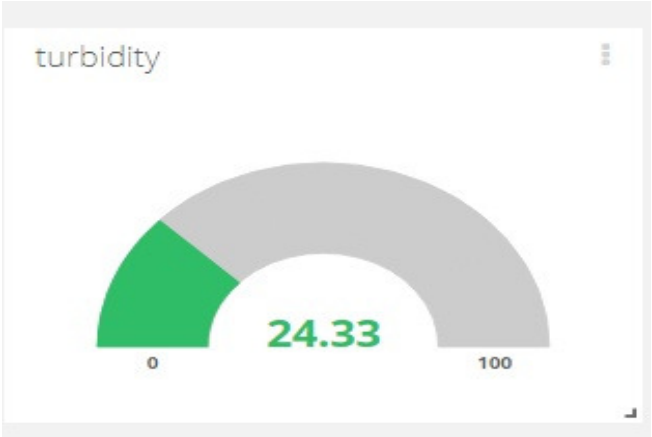
Then enter the login information and IoT name to create the new IoT server as shown below in figure number 8.

Fig 8: shown step two enter email, username

Then you must add sensors to dashboard and complete the configuration.

3. Monitoring center: because we use IoT server and is available on the internet so that monitoring center can be in any location has the internet to access the IoT server. In our case we use ubidotes and it provide wide range of display way. The simplest graphical user interface (GUI) was used to present all data collected from the sensing nodes. a clear graph and flowchart were used to represent data on a long period to easily detect any change in water parameters.

A. Turbidity sensor



Data collected from turbidity sensor as show below in Figure number 9.

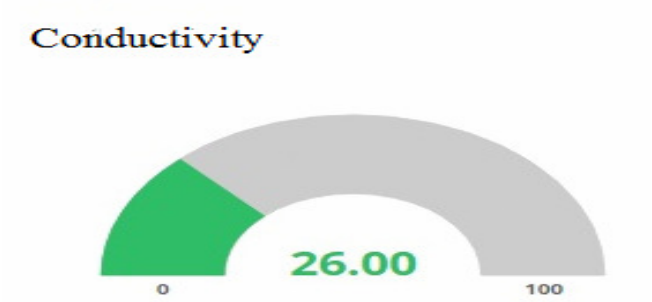


Fig 9: Reading of turbidity sensor

B. Conductivity sensor: Data collected from Conductivity sensor as show in Figure number 10.

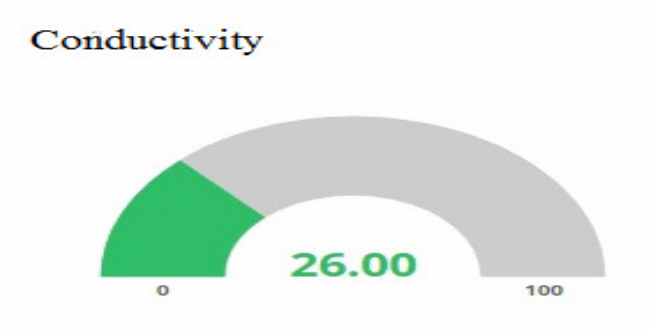


Fig 10: Reading of Conductivity sensor

C. Temperature sensor

Data collected from Temperature sensor as show in Figure 11.

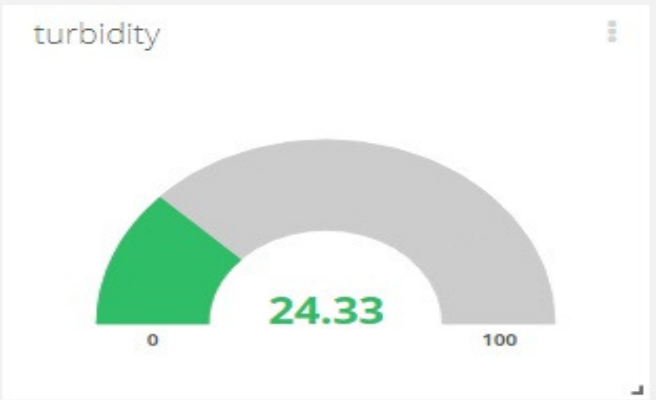


Fig 11: Reading of temperature sensor

Algorithm

The algorithm used in the proposed project at the sensing node present in figure number 12. This algorithm start when power on and the NodeMcu wake up the sensor then read the data from these sensors after that check if the internet is available or not. It sends the data to the IoT server when the internet available and returns to reading from the sensors if not available.

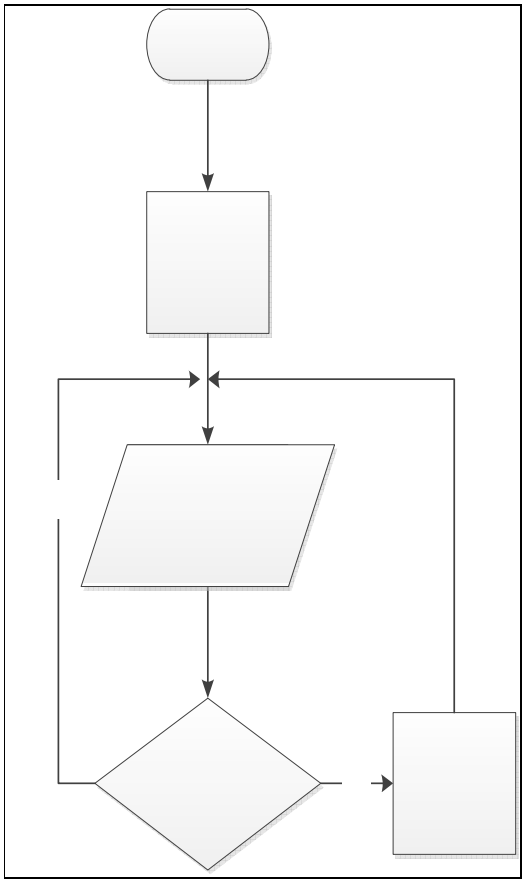


Fig 12: The algorithm used in the proposed system

Hardware implementation of project

The proto type of hardware implementation of project present in figures below**.**

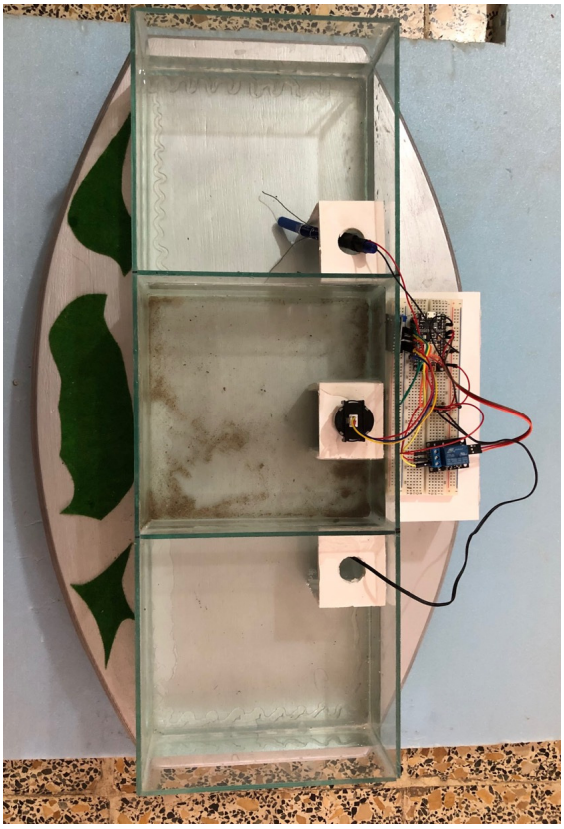


Fig 13: shown final project

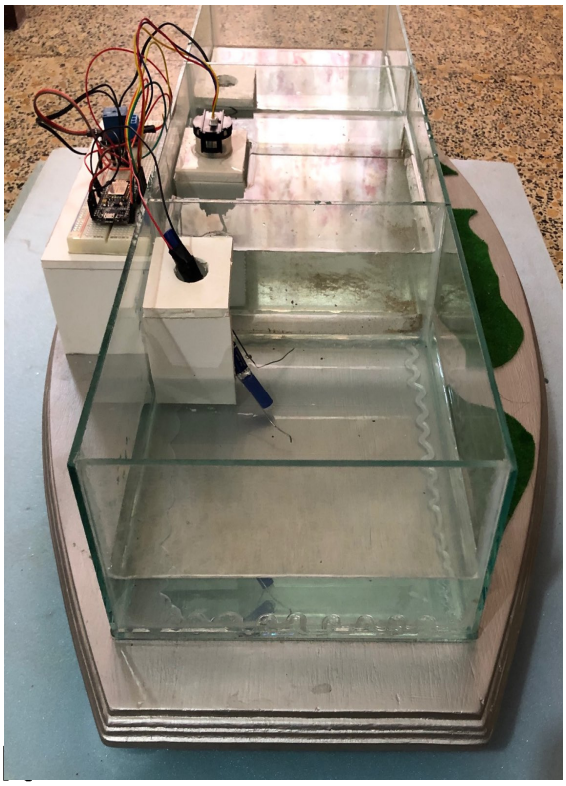


Fig 14: shown final project

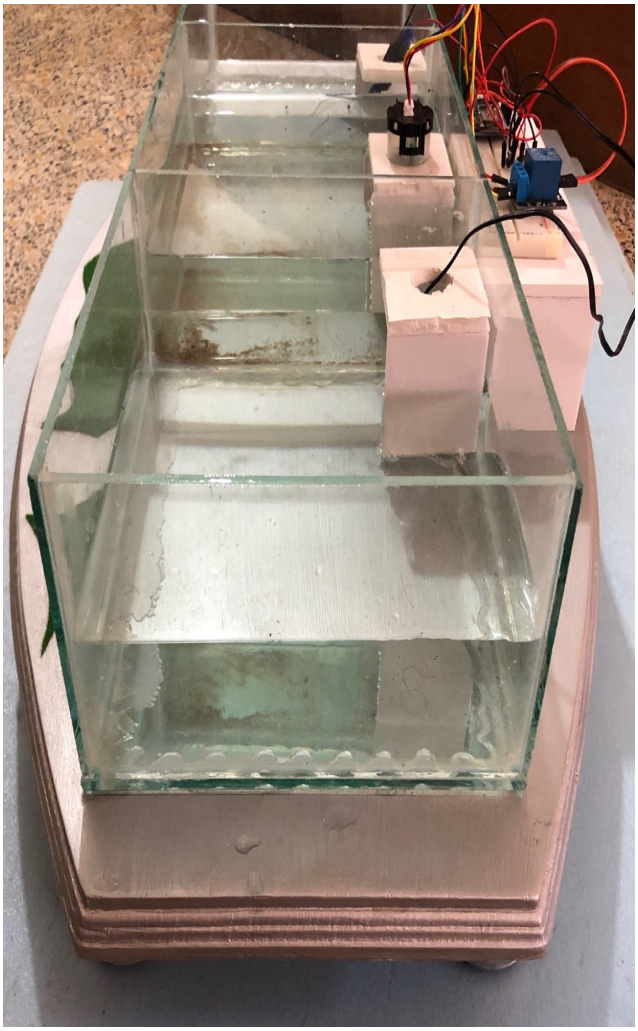


Fig 15: shown final project

Conclusion and Future Work

Based on existing methods using for water quality monitoring we can say that the proposed project is more suitable to monitor parameters of water in real-time. The proposed system introduces internet of things technology using several sensors to measure water quality, each sensing node contains three-sensors and data collected from sensors send in real-time through the internet to the IoT server. In this system, we built one sensing node only as a case study. As future work, surface water pollution monitoring system based on IoT can be extended to build more than one sensing node and spread these nodes at specified locations of Iraqi rivers such as Tigris and the Euphrates to protect them from pollution.

References

Aaina Venkateswaran, P.P.B. and Menda, H.P. (2017). An IoT Based System for Water Quality Monitoring, Int. J. Innov. Res. Comput. Commun. Eng., 5: 8510–8515,.

Ahmed, S.K.; Sankari, S. and Professor, A. (2018). Smart Tank Water Monitoring System using IOT Cloud Server at Home/Office, Int. J. Eng. Sci. Comput., 8:16748–16751.

Bhatt, J. and Patoliya, J. (2016). Iot Based Water Quality Monitoring System, Iot Based Water Qual. Monit. Syst., 36–40.

Croock, M.S.; Al-Qaraawi, S. and Hamad, Q.S. (2017) Efficient wireless sensor network based monitoring system, Ad-Hoc Sens. Wirel. Networks, 35: 1–2.

Ghazi, K.; Al-Mukhtar, T. and Shihab, H. (2018). Design and implementation of a smart home automation system based on global system for mobile communications, J. Appl. Eng. Sci., 16: 471–479,.

Hamad, Q.S.; Taha, A.M. and Abdulrazzaq, A.A. (2019). Company attendance and access control system based on radio frequency identification, IOP Conf. Series: Journal of Physics: Conf., 1230:1-13.

Hamad, Q.S. (2017). University attendance and entrance control system using RFID, Baghdad, Iraq. J. Eng. Appl. Sci., 12: 9286-9294.

Kumar, R.K.; Mohan, M.C.; Vengateshapandiyan, S.; Kumar, M.M. and Eswaran, R. (2014). Solar Based Advanced Water Quality Monitoring System Using Wireless Sensor Network, Int. J. Sci. Eng. Technol. Res., 3: 385–389.

Madhavireddy, V. and Koteswarrao, B. (2018). Smart Water Quality Monitoring System Using Iot Technology, Int. Res. J. Eng. Technol., 5: 636–639,

Mishra, A. (2018). Air Pollution Monitoring System based on IoT: Forecasting and Predictive Modeling using Machine Learning, Int. Con. on Imaging, Signal Pro. and Comm.

Pal, P.; Gupta, R.; Tiwari, S. and Sharma, A. (2017). Iot Based Air Pollution Monitoring System Using Arduino, Int. Res. J. Eng. Technol., 3: 571–575,

Pappu, S.; Vudatha, P.; Niharika, A.V.; Karthick, T. and Sankaranarayanan, S. (2017). Intelligent IoT based water quality monitoring system, Int. J. Appl. Eng. Res., 12: 5447–5454,.

Rao, A.S.; Marshall, S.; Gubbi, J.; Palaniswami, M.; Sinnott, R. and Pettigrovet, V. (2013). Design of low-cost autonomous water quality monitoring system, Proc. Int. Conf. Adv. Comput. Commun. Informatics, ICACCI 2013, 14–19.

Rao, T.; Ling, Q.; Yu, B. and Ji, H. (2014). Estimate the densities of pollutions in water quality monitoring systems based on UV/vis spectrum, 26th Chinese Control Decis. Conf. CCDC 2014, 2984–2989.

Saleh, M.H. and Hamad, Q.S. (2017). Wireless Home Automation System Based on Microcontroller, J. Eng. Sci. Technol., 12: 3034–3043.

Sai, P.Y. (2017). An IoT Based Automated Noise and Air Pollution Monitoring System, Ijarcce, 6: 419–423,.

V.V.D. and Gaikwad, D.M. (2018). Water Quality Monitoring System Based on IOT, Adv. Wirel. Mob. Commun., 10: 1107–1116.

Wang, J.Y.; Cao, Y.; Yu, G.P. and Yuan, M.Z. (2015). Research on application of IOT in domestic waste treatment and disposal, Proc. World Congr. Intell. Control Autom., 4742–4745.

Yauri, R.; Rios, M. and Lezama, J. (2017). Water quality monitoring of Peruvian Amazon based in the Internet of Things, Proc. 2017 IEEE 24th Int. Congr. Electron. Electr. Eng. Comput. INTERCON 2017, 1-7,.

Z.S.F., P.K.S.R., Rahul, R.; and S.K.C. (2019). IoT based Industrial Pollution Monitoring System, Int. Res. J. Eng. Technol., 6: 2038–2041,.