Journal of IoT in Social, Mobile, Analytics, and Cloud (ISSN: 2582-1369)
www.irojournals.com/iroismac/

Industrial Waste-Water Treatment Using IoT

[1]Y. Divya, [2] B. Achiammal, [3]Santosh Kumar Sahoo

[1]Research Scholar, Department of Electronics and Instrumentation Engineering, Annamalai University/ CVR College of Engineering, Ibrahimpatnam, Telangana, India.

[2]Department of Electronics and Instrumentation Engineering, Government College of Technology, Coimbatore, Tamil Nadu, India.

[3]Department of Electronics and Instrumentation Engineering, CVR College of Engineering, Ibrahimpatnam, Telangana, India.

E-mail: [1]y.divya@cvr.ac.in, [2]Nanthi12@gmail.com, [3]santosh.kr.sahoo@cvr.ac.in

Abstract

Environmental safety management has recently been the most difficult task in this rapidly urbanising country. Wastewater management is a method of treating waste that can be reused rather than thrown away. One of the most efficient ways to handle garbage is to reduce and recycle. For decades, wastewater treatment companies have been dealing with a plethora of difficulties centred on how to avoid trash being managed. Separating wastes thrown in water, such as paints and battery wastes, is difficult since they require a unique classification and recycling procedure. In Telangana, the waste developed from dairy industry requires to be treated properly for reuse of same due to scarcity of water. So, the Internet of Things (IoT) for a waste management solution is considered here to address the above concerns. Hence, the proposed method focusses on an IoT based wastewater treatment and monitoring for smooth operation and reuse. During implementation, it was concluded with confirmation that the proposed system has high accuracy in the range of 96% as compared to other existing models.

Keywords: IoT, Wastewater, Dairy Industry, Recycle

1. Introduction

Water being a most important resource is widely used for both general and commercial uses, as well as industrial applications. However, only around 2% of the water accessible on

DOI: https://doi.org/10.36548/jismac.2023.2.003
Received: 02.04.2023, received in revised form: 02.05.2023, accepted: 16.05.2023, published: 26.05.2023

the planet's surface is drinkable. As a result, it is becoming increasingly necessary to begin using treated water as an option to meet global water demands.

To improve the quality of the products, industries employ freshwater as a coolant and solvent. Directly exposing this contaminated water to the environment can cause intoxication. As a result, industries must build a wastewater treatment facility on their property to ensure that discharge and safety standards are properly taken care.

A wastewater treatment system cleans used water. It filters out hazardous and dangerous waste from water before returning it to a water body. This decreases the risk of water pollution and guarantees that toxic waste has a minimal environmental impact. This water can also be utilised for other purposes, both domestic and industrial. In the state of Telangana, several dairy production units are established and their wastewater plays a crucial role for the environment. Hence, the proposed research is on monitoring and treating the wastewater efficiently for further use. Ramos et al.[1] proposed a model for analysing the performance and monitoring parameters associated with the smart water grids. With their proposed unit they achieved 85% of accuracy and limitations of computation complexity.

Kalirajan et al. [2] used the IoT platform for managing the waste management system in order to effectively nullify the harmful effect on the environment. Prasad et al. [3] implemented a drinking water quality assessment unit for public health, to remove the harmful concentrations present in drinking water by proper optimization. Yuan et al.[4] utilized computer vision for monitoring the water quality using a biological sensor unit with a neural model to classify the feature parameter of the water quality. This achieved 100% of accuracy for detection and classification process. Pavana et al.[5] designed low-cost model for monitoring of real-time water quality in an IoT environment this method incurred accuracy , sensitivity and computational issue. Nikkam et al. [6] analysed the water quality for industrial application in IoT platform. Various toxic parameters associated with water quality wasverified in real-time platform with a high accuracy of 89%. Zhao et al. [7] developed a feedforward neural network model based on controllable parameters for predicting effluent total nitrogen with an accuracy of 94% and moderate computational speed.

By considering above facts, the proposed research focus on the followings:

1. To design an efficient treatment unit for dairy industry through IoT platform
2. Integration of IoT plat form for real time monitoring of industry wastewater

2. Methodology

The projected work module includes the analytical unit connected to IoT platform followed by sensing elements. The sensing elements used for recording various toxic parameters associated with wastewater from dairy industry. The functional diagram present in figure1 shows the flowchart of the proposed work. In this model, the core of the analytical device is chromatography (Ion type) which is used for analysing different ion concentration related to toxic elements present in wastewater. ultraviolet detector is used for detecting the toxic elements. As shown in figure 1, the sample was taken from the outlet of drainage system of dairy industry and passed through the sample injection system. Generally, the sample injection system comprises of pump and reservoir. The main function of the pump module is to load the sample to chromatography column and forward it towards detector for detection and analysis. The detector used here is an ultraviolet detector operating at 300 nm and operated with 12V power supply.

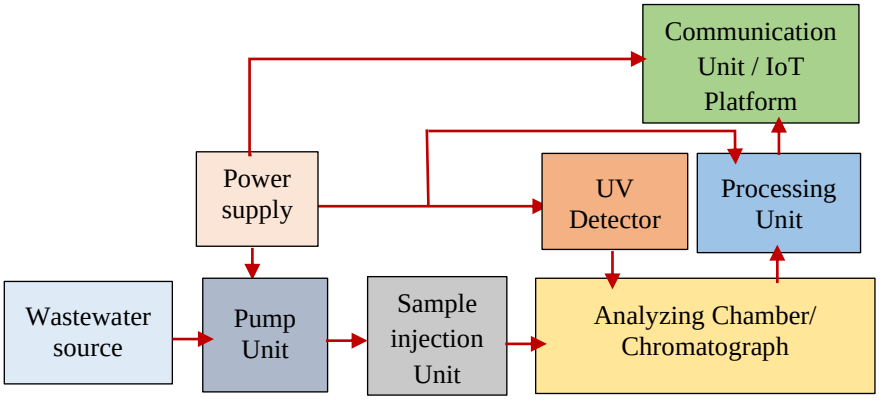


Figure 1. Functional block diagram of proposed model

A processing unit of 3.6 micro controller has used to process all the information associated to analyzing chamber and provide the outcomes to be communicated and monitored through IoT based communication platform attached to cloud and sensory elements. The IoT environment used in this proposed unit is basically thethings.io (middleware). As the IoT platform is a flexible unit to integrate any hardware and supports various protocol connectivity for information sharing and monitoring, hence it is also known as one of the major parts of the proposed work.

The hardware arrangement of the proposed scheme is presented in figure 2.

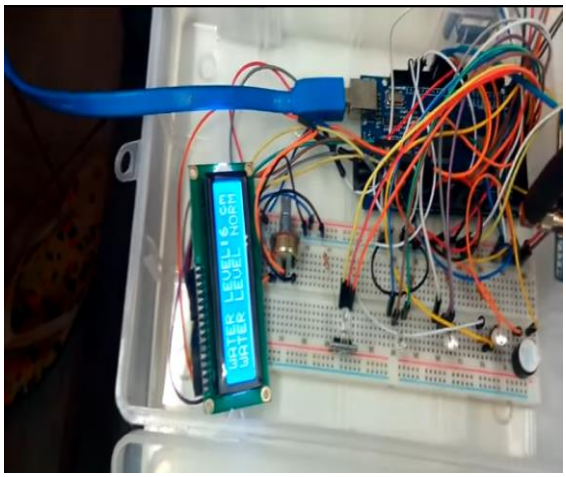


Figure 2. Hardware arrangement

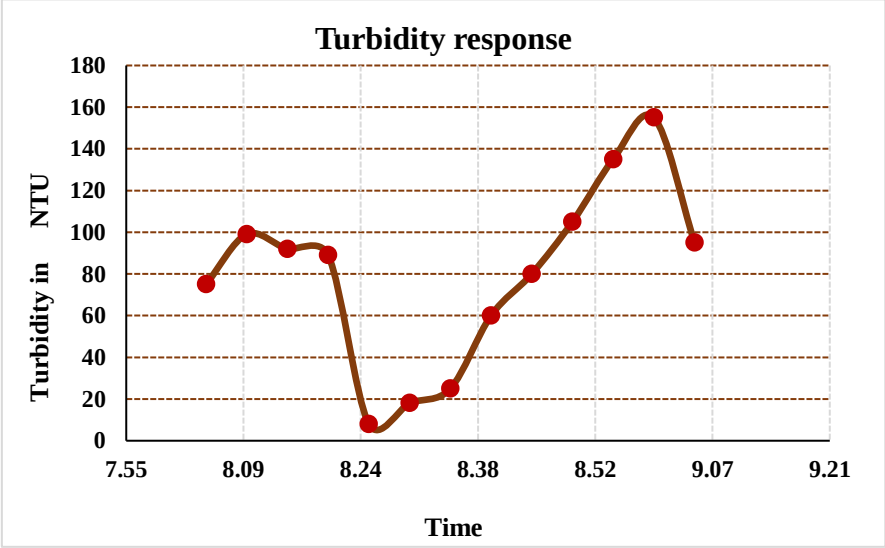
3. Result analysis

With the help of proposed model, the sample has collected form dairy industry with prior permission and same has investigated in real time simulation frame by collecting various effluents presents in the sampled water. The code shown in figure 3 is developed in python for the same purpose in order to achieve actual response corresponding to parameters associated to wastewater sample.

```
#include <OneWire.h>
#include <DallasTemperature.h>
#include <SoftwareSerial.h>
#include <NewPing.h>
#define SensorPin A2            //pH meter Analog out
#define Offset 0.00            //deviation compensate
unsigned long int avgValue;     //Store the average v

#define TRIGGER_PIN  23  // Arduino pin tied to trigg
#define ECHO_PIN     22  // Arduino pin tied to echo
#define MAX_DISTANCE 200 // Maximum distance we want

NewPing sonar(TRIGGER_PIN, ECHO_PIN, MAX_DISTANCE); /

unsigned int pingSpeed = 50; // How frequently are we
unsigned long pingTimer;     // Holds the next ping t
```

Figure 3. Sample code for proposed model

The response of the turbidity parameter has been recorded from the sensory elements output by graphical display unit presented in figure 4.



ss

Figure 4. Turbidity response recoded during experimentation**.**

During the experimental analysis the different behaviour of the proposed model has summarized in table-1. From this table it is concluded that the proposed unit can effectively detect the toxic concentration with high accuracy.

Table 1. Experimental outcomes

Parameter	Value before treatment	After treatment Value
Turbidity (NTU)	60	41.10
pH	100	80
BoD(mg/l)	875	60
CoD (mg/l)	1720	98.3

4. Conclusion

In this proposed research work, an IoT platform used for monitoring of dairy industry wastewater is implemented and validated. During its inspection phase it has been noticed that the accuracy of the proposed work is satisfactory and effectively functioning. The

computational time is also optimal during validation and monitoring. The result obtained from the real conditions of dairy industry of Telangana state for trial basis and the same is successfully experimented.

References

[1] Ramos, H. M., McNabola, A., López-Jiménez, P. A., & Pérez-Sánchez, M. (2019). Smart water management towards future water sustainable networks. Water, 12(1), 58.

[2] Kalirajan, K., Nambiar, M. V., Vinodhini, K., & Ramya, E. (2021, May). IoT Based Industrial WasteWater Monitoring and Recycling. In Journal of Physics: Conference Series (Vol. 1916, No. 1, p. 012119). IOP Publishing

[3] Prasad, G., Reshma, A. S., & Ramesh, M. V. (2021). Assessment of drinking water quality on public health at Alappuzha district, southern Kerala, India. Materials Today: Proceedings, 46, 3030-3036.

[4] Yuan, F., Huang, Y., Chen, X., & Cheng, E. (2018). A biological sensor system using computer vision for water quality monitoring. Ieee Access, 6, 61535-61546.

[5] Pavana, N. R., & Padma, M. C. (2016). Design of low-cost system for real time monitoring of water quality parameters in IoT environment.

[6] Nikkam, S. M. G., & Pawar, V. R. (2016). Analyzing water quality for industrial application under IOT environment. International Research Journal of Engineering and Technology, 3, 882-885.

[7] Zhao, Z., Wang, Z., Yuan, J., Ma, J., He, Z., Xu, Y., ... & Zhu, L. (2021). Development of a novel feedforward neural network model based on controllable parameters for predicting effluent total nitrogen. Engineering, 7(2), 195-202.