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PROPOSED PROMINENT RULE MODEL BASED CONTROL & INTERNET OF THINGS (IoT) SCRIPT MONITORING ALGORITHM

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Abstract

This paper focuses on the collecting and storage of data in cloud servers utilising Internet of Things (IoT) frameworks, as well as defining the security and privacy of data saved via cloud servers, two of the most significant mapping features of air quality monitoring in metropolitan areas. Each of the study's aims has been addressed using tried-and-true computational techniques. The goals were motivated by a horrifying issue, namely the death of nearly 1.2 million people annually due to air pollution. The core cause of the issue exposes a number of contributing variables, but the one that can be singled out is the impact of industrialisation and the general public's lack of understanding. Every type of climate change is driven by human activity, which also significantly contributes to environmental damage. People must be sufficiently motivated in order to have the necessary impact on the environment, notably on air quality, for this to happen. In this context, having a proper monitoring system at the appropriate location that will accurately record data related to air quality parameters, producing reports and issuing alerts, along with data security, are two factors that are of the utmost importance for air quality.

Key words : Cloud servers, human activity, monitoring system

Introduction

Characteristic components (the air we inhale , the water we drink, the radiation we are presented to, and so forth.) and artificial ecological changes (territory, work environment, travel, industry and other development exercises) assume an essential part among the different elements influencing a person's wellbeing. Synthetic operators that are delivered from different anthropogenic exercises into the environment truly influence human wellbeing.

One significant course by which these synthetics and poisonous specialists enter the body and cause diseases, including mortality, is the respiratory framework. All around the world, a great many individuals experience the ill effects of respiratory issues and different ailments because of the presence in the demeanor of poisonous substances and natural operators [Reducing chances, advancing wellbeing. World Health Organization Study, Geneva, 20021. While the convergence of any contamination in the air is a quantitative articulation of the presence of the toxin, there is no presentation except if there is immediate connection with people [Janssen, N., and Personal introduction to airborne particulate issue. Presentation means the event of a particular period when an individual comes into contact with a toxin. Then again, the dose identifies with the genuine measure of toxin breaking a body's boundary. Airborne particulate issue (PM) is the global network's new need since it enters the human respiratory framework and prompts numerous infections. On account of PM, it is believed that streamlined environmental PM size, number and amount assume a significant part in influencing human wellbeing.

Worldwide examinations have additionally demonstrated that the metropolitan populace is in danger because of raised PM levels in the metropolitan climate. A few time arrangement and associate examinations have indicated that, because of air contamination, newborn children, old and asthmatic people are at more serious danger.

Indeed, even with strong epidemiological examination, understanding and finding the wellbeing status of a network/populace is an unfathomably perplexing idea. One of the key purposes behind this trouble lies in the multi-factorial presence of the introduction vectors associated with wellbeing. Nourishment, mental and social conditions and the general indoor and open air natural states of the populace under examination are a portion of these components. Based on which the presentation reaction capacities have been estimated, significant writing exists on the effect of these elements on human wellbeing.

Existing Algorithm

A Fuzzy based water quality monitoring system utilising WSN was proposed by Priya et al. (2018). The physiochemical characteristics of water quality, including conductivity, temperature, pH, oxidation-reduction potential, and turbidity, were measured by this device. Water quality sensing devices were used to sense parameters, and data from these measurements was sent to a fuzzy-based controller. A Fuzzy-based system keeps track of the water quality in specific homes' pipelines. The valve to the remaining streets is closed if the contamination limit exceeds the threshold determined using fuzzy based decision making logic. The Fuzzy based method focused mainly on the pipeline water quality of certain residences. The complete system's installation was expensive. The sensors were still in the pipeline. In comparison to the Prominent Rule Control algorithm, measuring and monitoring water quality required a lot of time (PRC). It was impossible to transmit and receive secure data. In comparison to PRC, the fuzzy-based system performed less efficiently.

Measurements of contaminants such electric conductivity, pH, temperature, chloride, and soluble oxygen were suggested by Jindal et al. (2018). Using a localization and communication technique based on time of arrival, the measured data from the sensors was sent to the surface station. At a surface station, the data was analysed after being retrieved from sensors in order to check the water quality utilising timely preventive monitoring. It utilised user-operated, inter-functional, low power, and quick measurements without modelling while also including a sizable amount of tracking findings in a brief period of time. Despite the significant implementation costs. Data transfer that was secure was not possible.

The portable and online water monitoring (OWM) system employing WSN was proposed by Ibnu et al. in 2017. The OWM system includes a number of quantitative metrics, including salinity, conductivity, conductivity, pH, dissolved oxygen, turbidity, and temperature. In that study, the local main station system's OWM system used continuous data sampling at a higher sampling rate. Wi-Fi was also included into the system. As a result, real-time measurement was possible. In this existing study, the proposed technique required minutes to acquire data from probes. Because expensive probes were used to check the water quality, the cost of the complete system was exorbitant. Although it takes minutes, the sample testing time period was similarly lengthy. This previous technique did not establish secure data storage.

Proposed PRC Algorithm In IoT

The suggested study suggests Prominent Rule model based Control and IoT script monitoring method for water quality monitoring and control in order to increase the accuracy of real-time data estimate and measurement. This system's main goal is to construct a low-cost Internet of Things for tracking various water contaminants, including Temperature, Conductivity, pH, and Turbidity using integrated sensors.

Block Diagram of PRC

Figure 1.1 shows the block diagram of the suggested Prominent Rule model based Control and IoT script monitoring algorithm for monitoring water quality.

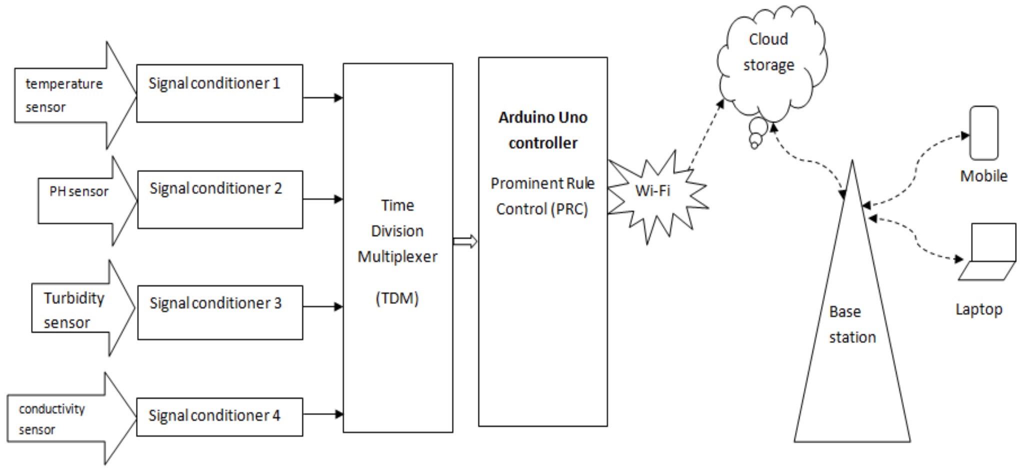


Figure 1.1 Block Diagram of PRC

The four separate sensors that make up the PRC-based water quality monitoring system are used to measure water quality indicators like temperature, pH, conductivity, and turbidity. Physical amount is changed into electrical quantity. Separate signal conditioners were used to condition the outputs of each sensor. It provides signal amplification, filtering, or linearization based on the sensor output and the received signal. Each water quality measure was given a different time slot to travel through the Time Division Multiplexer (TDM). The analogue pins of the Arduino Uno Controller were filled with the conditioned signals. Analog to Digital Converter built-in. It transforms analogue signals into digital ones. The PRC algorithm enabled the system as a whole. The Arduino Uno Controller was programmed with all of the set point values using the PRC algorithm and the Arduino programming language. The PRC compares the measured value to the set point value and, based on the difference, takes corrective action by sending an SMS warning to a nearby water quality monitoring facility. The newly developed PRC method securely saved all of the measured water quality metrics on the Internet.

Temperature Sensor

The LM35 temperature sensor was employed in this study. Figure 1.2 illustrates the construction of it. It was used to gauge the water's temperature. It was basically low cost and conveniently available sensor. It just cost 57 Rupees. Thermocouples, Resistance Temperature Detectors (RTDs), thermistors, and infrared sensors are just a few of the many types of temperature sensors available today.

Figure 1.2 Lm35 Temperature Sensor

Figure 1.3 shows the temperature sensor circuit for the LM 35 amplifier.

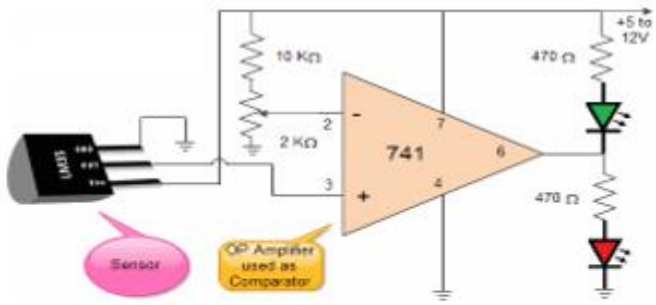


Figure 1.3 LM35 Temperature Sensor Circuit

The output voltage rises in direct proportion to the rise in water temperature. It was well-linear. The LM35 temperature sensor has the following features:
Reduced cost owing to wafer-level cutting;
Operates from 4 to 30 Volts;
Directly calibrated in Celsius (Centigrade);
Rated for entire 55 to +150 C range;
Ideal for remote applications;
Calibrated in Celsius (Centigrade);
Low self-heating,

pH Sensor

An aqueous solution's acidity or alkalinity can be determined by its pH. When a solution is acidic, its pH falls between 0 and 6.9. If a solution is alkaline, its pH falls between 7.1 and 11. The pH of pure or deionized water is 7.0, which is neutral. Nearly all water quality applications assess pH, which is a crucial parameter.
The three-way pH detector has the following features.
It had a green colour.
The probe's length was around 180 mm, and its overall dimensions were about 260 x 58 x 36 mm. Polymers and stainless metal were utilised for the construction. Moist readings ranged from 0 DRY to 10 WET, while light readings ranged from 0 DARK to 2000 LUMEN.
• pH values between 8 ALKALIN and 3.5 ACIDIC

Figure 1.4 Three Way pH detector

The 3-way pH detector is the ideal instrument for determining the pH level of water. It can be used to measure the pH of any liquid and to find moisture in soil. It is simple to use and highly accurate. The structure of the pH detector with amplifier circuit is shown in Figure 1.1.

Several treatment procedures for waste water are pH-dependent, and pH regulation is a requirement for disposal permits. High or low pH readings in environmental sampling and monitoring might be a sign of contamination. The pH sensor circuit schematic that is part of the signal conditioner is shown in Figure 1.5. The pH values of various solutions are displayed in Table 1.1. The PRC was loaded with these values.

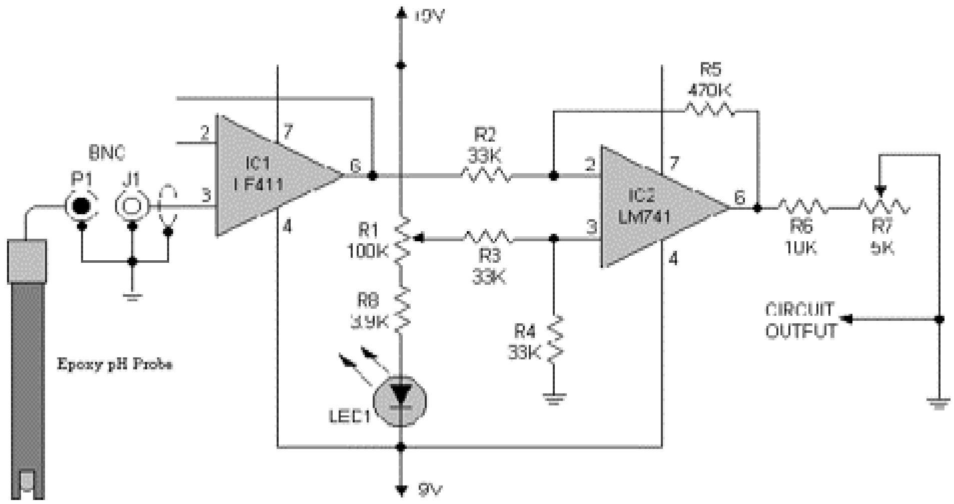


Figure 1.5 : pH Sensor Circuit

Table 1.1 : pH Value of Different Solution

Solution	PH Value
Battery Acid	0-1
Stomach Acid	2
Coco Cola	2.53
Gatorade (Lemon Lime)	2.93
Black coffee	5
"Pure" Water	7
Toothpaste	8-9
Household Bleach	12-13

Turbidity Sensor

The amount of light scattered by the suspended solids in water is measured by turbidity sensors. TST10 Turbidity Sensor was employed in this study. According to the WHO, the turbidity of drinking water should ideally be less than 1 NTU and should not exceed 5 NTU.

Figure 1.6 : TST10 Turbidity Sensor

In Figure 1.6, the TST10 turbidity sensor is depicted. In this study, it was employed to measure the turbidity of a water sample. Its maximum current rating was 30mA, and its operating temperature range was between -10°C and 90°C. Its voltage rating was 5V DC. The minimum insulation resistance was 100M by 500V DC, and the rated current was 30mA.

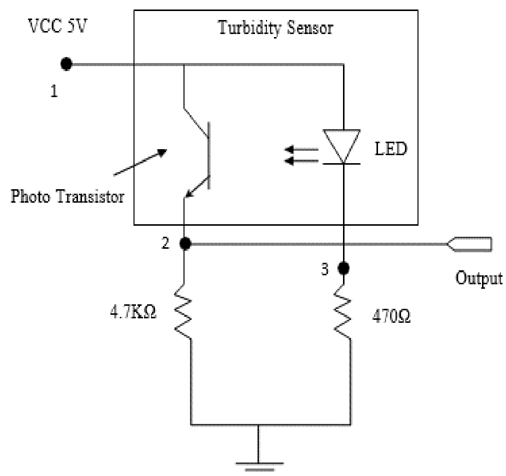


Figure 1.7 Circuit of Turbidity Sensor

The Turbidity sensor worked on the premise that the quantity of soil in the water would determine how much light would flow through a sample of water when it was exposed to it. The amount of light that was transmitted was measured by the turbidity sensor to ascertain the water's turbidity. Figure 1.7 shows the turbidity sensor's internal circuit.

Conductivity Sensor

Electric flow through water can be measured using conductivity. The amount of ions present in the water has a direct impact on this ability. These conductive ions are produced by inorganic substances such alkalis, chlorides, sulphides, and carbonate compounds and dissolved salts.

The total ion concentration of aqueous samples can be determined using the conductivity sensor, which can also measure solution conductivity. One of the most popular environmental tests for aquatic samples is conductivity. The conductivity sensor construction employed in this study is depicted in Figure 1.8.

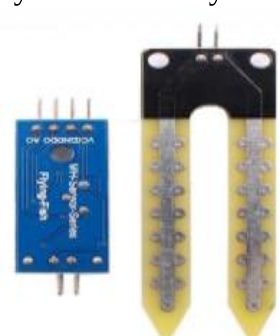


Figure 1.8 : Conductivity Sensor

The following are the specifications. The set point values input into the PRC algorithm are shown in Table 1.2.

1. The range for measuring conductivity is 0.000 to 2.000 S/cm.
2. Titanium was the moist material used.
3. The temperature and pressure ratings are determined by the temperature and pressure range, the material of the sensor, the mounting method, and the mounting hardware.

1. The maximum flow rate is 3 metres (10 feet) per second.
5. 60-foot sensor-analyzer distance (18.2 meters)

Water's capacity to carry an electric current between two electrodes is measured by the conductivity sensor. Ion transfer is how current moves through a solution. Thus, larger conductivity values will be produced as the ion concentration in the water increases. A voltage is created from this current.

Table 1.2 : Conductivity Set Points

Conductivity set points	**Types of water**
0.042µS/cm	ultrapure water (20°C)
0.5to5 µS/cm	deionized water
100To300µS/cm	Soft ground water
45000 to 55000 µS/cm	Seawater
5 to 50 ms/m	Pure drinking water

Signal Conditioner

Signal conditioning is the process of modifying an analogue signal so that it satisfies the requirements of the following step of supplemental processing. A signal conditioner is a device that turns one type of electric signal into another type of signal. Its main function is to transform a signal into a format that is easier to interpret by modern instruments. In this study, pH, turbidity, temperature, and conductivity sensors were each subjected to one of four signal conditioning circuits. Figure 1.9 shows the circuit diagram for the signal conditioning circuit with the ADC. Based on the sensor output, the circuit conducted signal amplification, filtration, electrical isolation, or linearization.

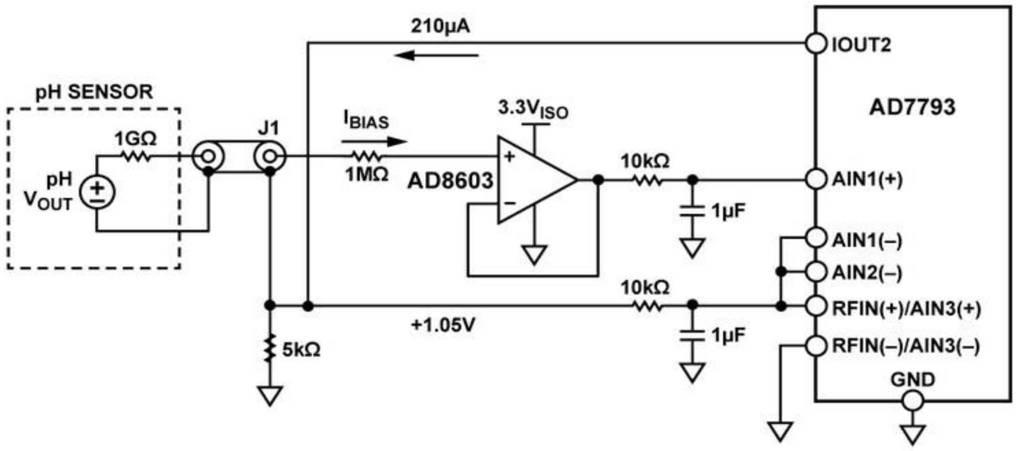


Figure-1.9 Circuit Diagram Of Signal Conditioner

The operational amplifier, filter, and analog-to-digital converter circuits make up the signal conditioning circuit.

Time Division Multiplexer

A multiplexer, that is. The IC 4066 TDM used in this study is seen in Figure 1.10. It accepts four inputs from the signal conditioner but only permits one output to move on to the following stage. All of the inputs advanced to the following level based on the various time windows (a few seconds apart).

Figure-1.10 IC4066 TDM

It is an integrated circuit with 14 pins (IC). Figure 1.11 displays the pin diagram. There were four output pins and four input pins on it. It needed +5V DC to function. By using synchronised switches at both ends of the transmission line, time-division multiplexing (TDM) is a technique for sending and receiving separate signals across a single signal path. As a result, each signal only appears on the line intermittently in an alternating pattern.

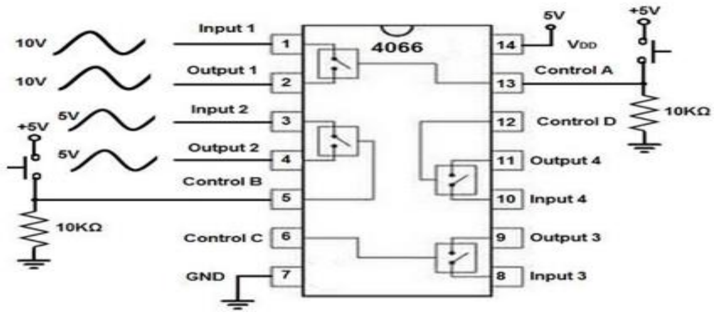


Figure 1.11 Pin Diagram of IC4066

A sample and hold circuit is used. The IC 4066 contains 4 switches and is a quad bilateral switch circuit. There is only one input and one output terminal per switch. Moreover, every switch has a control or enable terminal. The control or enable terminal needs to be high for signals to travel from the input side to the output side. It enabled all of the measured water quality metrics to reach the Arduino Uno controller in less than milliseconds of difference. Hence, the testing period for the water sample is relatively brief.

Wi-Fi Transceiver Module

A self-contained System On-Chip (SOC) with an integrated Transmission Control Protocol/Internet Protocol (TCP/IP) stack, the ESP8266 Wi-Fi (Wireless Fidelity) Module enables PRC to connect to wireless networks. It was employed in this instance to transmit data from the PRC to Internet cloud storage. Through Base Station (BS) and satellite, it was also used to transmit SMS alerts to the Water Quality Monitoring Center.

Figure 1.12 ESP8266 Wi-Fi Transceiver Modules

Figure 1.12 shows the Wi-Fi transceiver module in detail. Below is a list of the main characteristics of the ESP8266 Wi-Fi module:

• Wake up and transmit packets in less than 2ms; standby power consumption is less than 1.0mW; integrated TR switch, balun, Low Noise Amplifier (LNA), power amplifier, and matching network; integrated PLL, regulators, and power management units; 32 KB instruction RAM; 32 KB instruction cache RAM; 80 KB user-data RAM; 16 KB ETS system-data RAM;

Results and Discussion

Figure 1.13 shows the water quality monitoring system utilising the Prominent Rule model-based Control and IoT script monitoring algorithm web page display screenshots.

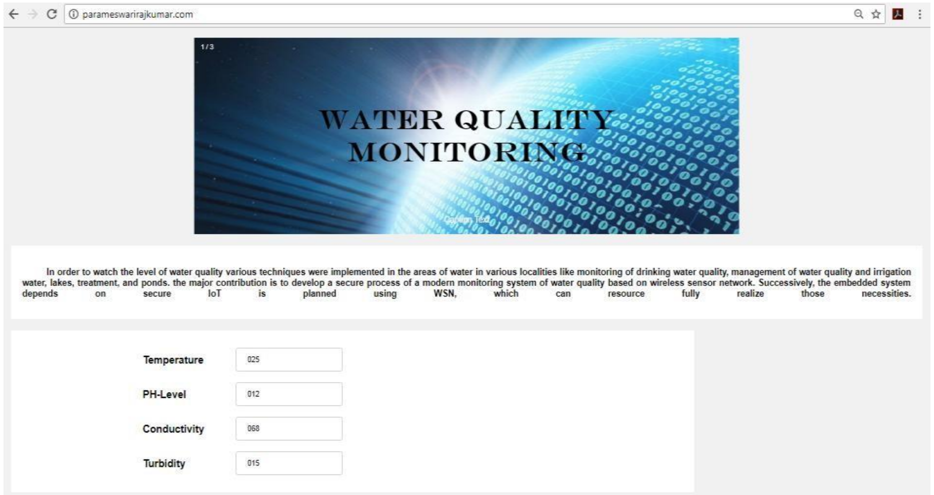
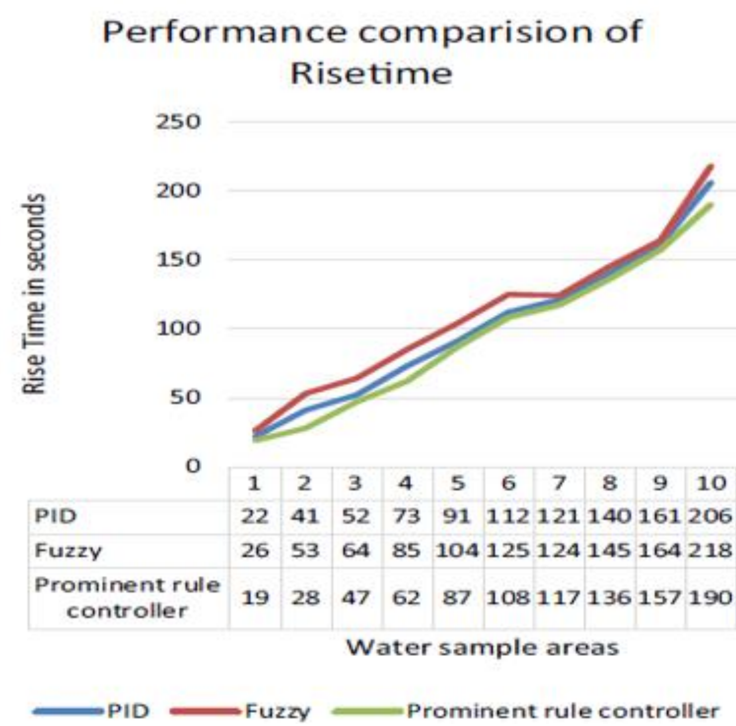


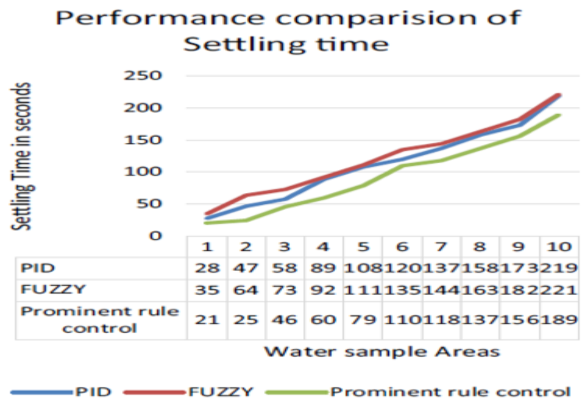
Figure1.13 PRC on web page



	1	2	3	4	5	6	7	8	9	10
PID	22	41	52	73	91	112	121	140	161	206
Fuzzy	26	53	64	85	104	125	124	145	164	218
Prominent rule controller	19	28	47	62	87	108	117	136	157	190

Figure 1.14 Performance Analysis of Rise Time Using PRC

Figure 1.14 displays the rise time values for water sample 1 that range from 22 seconds for PID-based controls to 26 seconds for fuzzy controls to 19 seconds for suggested Prominent Rule controls. Prominent Rule Controller decreases the rising time as little as possible within a reasonable range based on the analysis.



	1	2	3	4	5	6	7	8	9	10
PID	28	47	58	89	108	120	137	158	173	219
FUZZY	35	64	73	92	111	135	144	163	182	221
Prominent rule control	21	25	46	60	79	110	118	137	156	189

Figure1.15 Performance Analysis of Settling Time Using PRC

The performance analysis of the prominent rule controller's settling time is shown in Figure 1.20. According to the analysis, the suggested Prominent Rule Control for the water sample requires just 21 seconds, compared to the 28 seconds required for PID-based control, 35 seconds for fuzzy-based control, and 35 seconds for fuzzy-based control, respectively.

The performance study of controller error using PRC is shown in Figure 1.21. According to the results, the PRC system has significantly less inaccuracy than other systems.

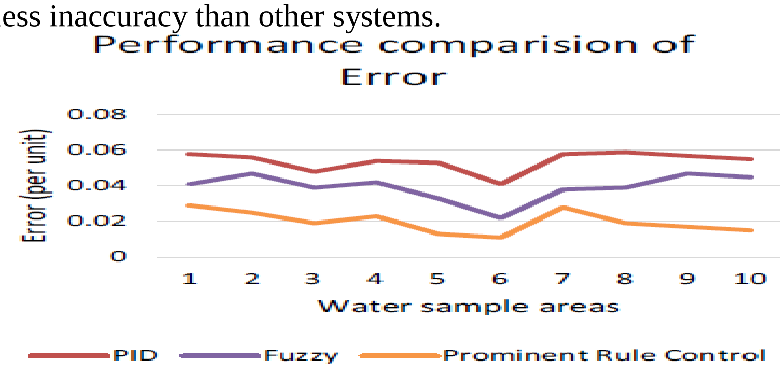


Figure 1.15 Performance Analysis of Controller Error Using PRC

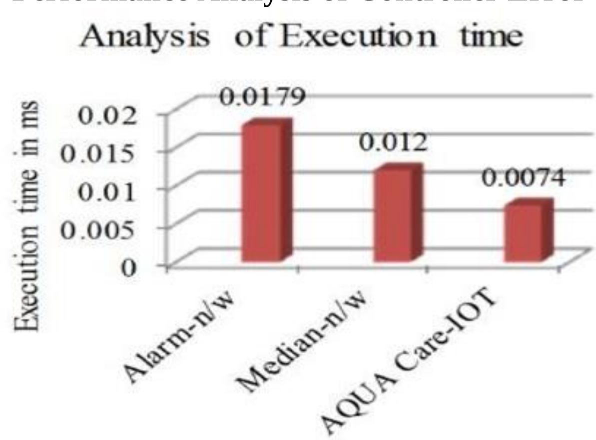


Figure 1.16 Performance Comparison Based on Execution Time

Figure 1.16 shows that the Prominent Rule Control Aqua care-IoT operates much more quickly than other systems. The testing of the water sample only takes 0.0074 seconds to complete.

Conclusion

This paper discusses current water quality monitoring algorithms and their shortcomings, a detailed block diagram of the proposed PRC, how it operates, how all of its components are built, how data flows through it, how cloud storage works, and how sample water analysis for various water samples is done. The Prominent Rule model based Control and IoT script monitoring method is highly suited for real-time water quality monitoring and control from any location, according to the observed results. Significant advantages offered by the suggested system include inexpensive implementation costs, minimal power usage, and quick sample testing. an s,,,,,,,,,,,,,,,,,,,,,,. The suggested system functions both online and off. The proposed PRC water quality monitoring system gives people the ability to protect themselves from dangerous water dangers.

References

- Suman. Air Quality Indices: A Review of Methods to Interpret Air Quality Status. Mater. Today Proc. 2019, 34, 863–868.
- Chen, J.; Yu, X.; Sun, F.; Lun, X.; Fu, Y.; Jia, G.; Zhang, Z.; Liu, X.; Mo, L.; Bi, H. The Concentrations and Reduction of Airborne Particulate Matter (PM10, PM2.5, PM1) at Shelterbelt Site in Beijing. Atmosphere 2015, 6, 650–676
- Ghorani-Azam, A.; Riahi-Zanjani, B.; Balali-Mood, M. Effects of Air Pollution on Human Health and Practical Measures for Prevention in Iran. J. Res. Med. Sci. 2016, 21, 65.
- Dhimal, M.; Chirico, F.; Bista, B.; Sharma, S.; Chalise, B.; Dhimal, M.L.; Ilesanmi, O.S.; Trucillo, P.; Sofia, D. Impact of Air Pollution on Global Burden of Disease in 2019. Processes 2020, 9, 1719
- Lin, Y.-P.; Mukhtar, H.; Huang, K.-T.; Petway, J.R.; Lin, C.-M.; Chou, C.-F.; Liao, S.-W. Real-Time Identification of Irrigation Water Pollution Sources and Pathways with a Wireless Sensor Network and Blockchain Framework. Sensors 2020, 20, 3634.
- Kongar-Syuryun, C.; Tyulyaeva, Y.; Khairutdinov, A.M.; Kowalik, T. Industrial Waste in Concrete Mixtures for Construction of Underground Structures and Minerals Extraction. IOP Conf. Ser. Mater. Sci. Eng. 2020, 869, 032004
- Nair, A.T.; Senthilnathan, J.; Nagendra, S.M.S. Emerging Perspectives on VOC Emissions from Landfill Sites: Impact on Tropospheric Chemistry and Local Air Quality. Process Saf. Environ. Prot. 2019, 121, 143–154
- Kabirifar, K.; Mojtahedi, M.; Wang, C.; Tam, V.W.Y. Construction and Demolition Waste Management Contributing Factors Coupled with Reduce, Reuse, and Recycle Strategies for Effective Waste Management: A Review. J. Clean. Prod. 2020, 525, 121265.
- Pochwała, S.; Gardecki, A.; Lewandowski, P.; Somogyi, V.; Anweiler, S. Developing of Low-Cost Air Pollution Sensor— Measurements with the Unmanned Aerial Vehicles in Poland. Sensors 2020, 20, 3582.
- Sun, X.; Luo, X.S.; Xu, J.; Zhao, Z.; Chen, Y.; Wu, L.; Chen, Q.; Zhang, D. Spatio-Temporal Variations and Factors of a Provincial PM 2.5 Pollution in Eastern China during 2013–2017 by Geostatistics. Sci. Rep. 2019, 9, 3613.