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REAL TIME SYSTEM ANALYSIS FOR AUDITING WATER QUALITY

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***ABSTRACT*-A Water is an essential factor which supports to increase living being life span on earth. A secure supply of water must be exposed to each and every living being on the earth. An improvement in the quality of water is beneficial for human health. The quality of water depends on various parameters which includes physical and chemical standards. The physical standards include color, turbidity, taste and odour and the chemical standards includes pH, DO (dissolved oxygen), conductivity, total harness, chlorides, sulphate, fluorides and TDS (total dissolved solid). In this paper, an analytical survey of existing water quality measurement methodologies, which includes traditional and modern methods for monitoring and analyzing the water quality. This paper also presents a detailed overview of recent works carried out in the field of smart water quality monitoring. It also includes a list of different sensors used for water quality analysis based on the parameters along with the standard quality range of the parameters.**

Keywords: Water Quality Analysis, Turbidity, pH, DO, TDS, chloride, sulphate, and Water Quality Sensors etc.,

I. INTRODUCTION

Currently, drinking water faces many challenges in the present situation. The drinking water is essential for all human beings. Due to the growing population, ageing infrastructure, inadequate water resources many challenges occurred [1]. so water quality methodologies required. Water is a fuel of life and no lives exist without water on this earth planet. The water has to be supervised regularly using smart technologies. There are different purification technologies proposed for supervising the drinking water; but the endangerment of different category is mixed with the drinking water which comes through industries, urbanization, agriculture resources etc.,

Safe [5] water is primary condition for health and also a basic human right but yet it is not accessible to all human kind. Due to which water related diseases increases day by day which causes 3.4 million deaths a year, mostly among children. Ensuring the safety of water is a challenge due the excessive sources of pollutants, most of which are man-made. The main causes for water quality problems are over exploitation of natural resources. The rapid [8] pace of industrialization and greater emphasis on agricultural growth combined with latest advancements, agricultural fertilizers and non-enforcement of laws have led to water pollution to a large extent. The problem is sometimes [3] aggravated due to the non-uniform distribution of rainfall. Individual practices also play an important role in determining the quality of water. Since there are many efforts made by government but still many people do not have access to improved water sources. In many developing countries contaminated water is being used for drinking without any proper former treatment. One of the reasons for this is unawareness

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in public and administration and the lack of water quality monitoring system which creates serious health issues [4]. As water is the most important factor for all living organisms it is necessary to protect it and water quality analysis is first step taken in rational development and management of water resources.

Water quality is a measure of suitability of water for particular use. It [2] depends on various physical, chemical and biological parameters. Generally measured water quality parameters are temperature, turbidity, pH, conductivity, dissolved oxygen (DO) and total dissolved solid (TDS). These parameters aremeasured routinely in order to maintain the good water quality.

The paper is structured as follows, in section 2, We discussed about the traditional approaches used for measuring water quality. Section 3 is focused on the current modern approaches used for water quality measurement using various techniques and conclusion is given in section 4.

II. EARLY APPROACHES USED IN WATER QUALITY MANAGEMENT SYSTEM

2.1. TRADITIONAL APPROACH

In traditional method, water parameters are detected by collecting samples manually and then send them to the well-equipped laboratories for further analysis where the testing equipment's are stationary and samples are provided to the testing equipment's.

2.1.1. OPERATIONAL AND COMPLIANCE MONITORING

The routine operational monitoring [9]and supervision of water quality, including compliance monitoring, is carried out in a variety of ways; often through a combination of responsibilities at various levels of administration. Monitoring [28] of raw water sources is usually done by the government departments, although some monitoring is also done by water suppliers to check the quality of their intakes. Self-monitoring by water companies and close scrutiny of these activities by the enforcement agency, as practised in England & Wales, Scotland and, increasingly, in the Netherlands, is relatively rare. The function is more typically carried out by government health laboratories, or other government appointed laboratories, whilst water suppliers undertake a minimum of routine operational monitoring. Often the laboratories of the water suppliers and those of the government health authorities, particularly where they are small and at local level, are not the best equipped or resourced facilities to deal with the considerable technical demands of the full range of water quality analyses, for example the low concentrations of organic contaminants prescribed in the EU Drinking Water Directive (80/778/EEC, replaced by 98/83/EC) or recommended in the WHO Guidelines for Drinking Water Quality (WHO 1993).

Traditionally [9], these laboratories are experienced and equipped mainly for dealing with - microbiological analyses, e.g. in France, where the best equipped laboratories are probably those of the major private water companies. These problems have been recognized in some instances; for example, in Germany, some laboratories of large water suppliers have been certified by the administrations to carry out analyses on their behalf, but these are only permitted to carry out compliance monitoring of other water suppliers, not their own. In England & Wales, where self-monitoring is practiced, the laboratories of the private water companies are generally good and well equipped, and participating in external quality control systems. Even in EU Member States where water quality standards and monitoring programs should be well established, some inadequacies in monitoring have been mentioned; for example, France and Belgium in relation to small supplies (due to high cost of analyses), Sweden in respect of pesticides and toxic elements; and major monitoring difficulties seem to be encountered in Greece because of technical and financial problems and inadequate human resources. Some other Western European countries also refer to monitoring problems due to inadequate human resources (Andorra, Malta) and insufficient

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monitoring at the numerous small supplies (Norway). 12 Most CEE countries seem to encounter considerable difficulties in routine and compliance monitoring, due to insufficient resources, technical and organizational problems and inadequate human resources. Where specified, the population receiving water which is regularly monitored, ranges from 15-84% in different countries. Moreover, understandably, monitoring often comprises a basic set of parameters, focusing on microbiological quality, pH, organoleptic properties and major ions, whilst many of the chemical parameters requiring sophisticated, expensive methods of analysis, such as toxic metals, pesticides, PAH etc., are rarely measured. There is clearly a need for operational water quality monitoring by water suppliers. However, this, together with the need for compliance monitoring by separate authorities leads to duplication of effort which is expensive and can divert valuable resources. This situation could be avoided by self-monitoring, together with effective controls on the monitoring activities, such as inspection of data, quality control systems and laboratory audits. It would be particularly relevant to make more use of such systems in countries where resources are particularly scarce. Another issue is the often inadequate monitoring of small and private supplies which are numerous in many countries.

TABLE 1: NON COMPILANCE AND REPORTS OF OPERATIONAL MONITORINGSYSTEM

Country[9]	Drinking water quality/ problems[9]	Reports[9]
Germany	Non - compliance problems: · coliforms, · nitrate, · atrazine. Reasons: agricultural activities. Some additional problems for geological reasons.	Some data available to the public
Greece	Major non - compliance problem: · Microbiological (total coliforms, fauecal coliforms). Reasons: non-continuous chlorination.	National level. Data available to public through inspection.
Sweden	Non - compliance: · iron, · manganese, · fluoride, · radon, · arsenic. Reasons: geological conditions, poor protection of raw waters, eutrophication, and inadequate treatment.	National level (general overviews only). Data available to public for inspection.
Norway	Non - compliance: · total coliforms, · faecal coliforms, · colour, · disinfection byproducts, · pH. Reasons: land use, geological/biological conditions. Many small private water works have inadequate treatment (disinfection, colour removal)	Regional level. Data available to public for inspection.

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Switzerland	No major problems, minor non-compliance problems: · microbiological, · nitrate, · chloride, · pesticides (atrazine), · volatile hydrocarbons, · occasionally EDTA. Reasons: agricultural and industrial contamination of source waters	Regional level (Cantons). Data available to public for inspection
Turkey	Non compliance: · microbiological parameters (total and faecal coliforms, aerobic mesofilic bacteria), · nitrate, nitrite, · organic substances. Reasons: agricultural activities, industrial discharges and geological reasons.	No reports No data available to public.

The above table gives the detailed report about drinking water quality in different countries and data that are known by the public.

2.1.2. SAMPLING AND MONITORING

Sampling could be defined as a process of selecting a portion of small material enough in volume to be transported conveniently and handled in the laboratory, while still accurately representing the part of the environment sampled. The main difficulties in sampling are representativeness and integrity. Many people think that the analysis starts when the sample arrives in the laboratory. However, sampling is an indispensable piece of the analytic procedure, so analysis begins with this. Sampling is the main contribution to the error of whole analytical process, especially when contamination is being measured. [6] discussed about a system, GSM based AMR has low infrastructure cost and it reduces man power. The system is fully automatic, hence the probability of error is reduced. The data is highly secured and it not only solve the problem of traditional meter reading system but also provides additional features such as power disconnection, reconnection and the concept of power management. The database stores the current month and also all the previous month data for the future use. Hence the system saves a lot amount of time and energy. Due to the power fluctuations, there might be a damage in the home appliances. Hence to avoid such damages and to protect the appliances, the voltage controlling method can be implemented.

The relative error, as well as the absolute possible error due to sampling, sampling preparation and instrumentation analysis, differs from matrix to matrix and it depends greatly on the range of concentration of analyses. In general, the possible error of instrumentalanalysis is relatively low. According to the analyses the possible errors are relatively great due to sampling and sample preparation [28]. Sampling should always start by defining the purpose of the measurement [4,21]. If the different stages are under the responsibility of different people, there needs to be good communication between all parties involved. The procedure are needed to be analysed and optimzed by analytical scientists and sampling planners.(including the sampling step). Both need to discuss the objectives of the measurements with the customer. Once the purpose of the analysis has been established, a sampling plan should be developed to achieve the purpose. This plan should be written as a protocol (standard operation procedure, SOP) that includes the following aspects (Fig.

1. when, where and how to collect samples;

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2. sampling equipment, including its maintenance and calibration;

3. sample containers, including cleaning, addition of stabilizers and storage;

4. sample-treatment procedures (e.g., drying, mixing and handling prior to measurements);

5. sub-sampling procedures; and,

6. sample record-keeping (e.g., labeling, recording information, auxiliary information, and chain-ofcustody requirements). The sampling plan should be written according to the purpose of the analysis and in advance of performing field sampling.

Currently, the most commonly used method for measuring levels of chemical pollutants for all three modes of monitoring is spot (bottle) sampling, followed by extraction and instrumental analysis. This methodology is well established and validated, so it has been accepted for regulatory and legislation purposes. However, this approach is only acceptable if it is representative of the chemical quality of water at a particular sampling site. We need to consider that spot samples are collected at a given location and time, and that the information obtained is unique to the place and the time selected. For surface waters, samples are often collected by directly filling the sample bottle. For more profound water layers, underneath around 0.5 m, these strategies don't work any more, so dedicated water samplers are utilized. They are lowered in an open condition on a rope or steel cable and remotely triggered to close. A third option is the use of pumps (e.g., peristaltic pumps offer the option of collecting larger amounts of water, and may be used together with in-line filtration, thus avoiding contamination (air dust) in the field). This is vital as a few parameters (e.g., pH, temperature and broke up oxygen) can't be dissected satisfactorily after transport to the research facility. Portable instruments should be properly cleaned and calibrated before starting the measurements.

The water quality is also determined by biological characteristics, so-called ‘‘ecological status’’. Indicator organisms to be collected include algae, bacteria, fish and macro-invertebrates. Benthic macro-invertebrates (e.g., mussels and worms) are bottom-dwelling organisms that live in or on the sediment of streams, rivers, lakes and the sea. They are more or less stationary, they do not migrate like fish, and are therefore a good indicator of the pollution status of the site investigated. For shallow waters, where it is possible to walk through the stream, collection is done by hand picking, or using a net held against the stream. For deeper waters, one needs to use samplers (e.g., a van Veen or Patterson grab sampler). After collection, sediments are sieved over, e.g., a 2-mm-mesh sieve. Analysis includes identification of the species and counting. . The samples should be registered as soon as they arrive at the laboratory. Sample log-in is important for legal purposes and tracing the sample.

Passive-sampling technology has the potential to become a reliable, robust and cost effective tool that could be used in monitoring programmes across Europe. In passive sampling, analyte concentration is integrated over the sampling time. This sampling approach is called time-weighted average sampling. Passive sampling is less sensitive to accidental, extreme variations of the pollutant concentration.
Most passive-sampling devices comprise a receiving phase and a diffusion-limiting barrier. The receiving phase is usually a sorbent material or organic solvent, which binds the sampled chemicals. Among the most widely-used samplers are semi-permeable membrane devices (SPMDs) for hydrophobic organic pollutants and the diffusion-gradient in thin-films (DGTs) for metal and inorganic compounds

TABLE 2: Selection of variables for assessment of water quality in relation to non-industrial water use

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	AQUATIC LIFE AND FISHERIES	Drinking-water sources	Agriculture/irrigation
GENERAL VARIABLES			
Temperature	XXX		
Turbidity/ transparency	XX	XX	
Conductivity	X	X	X
Total dissolved solids	X	X	XXX
Ph	XX	X	XX
Hardness	X	XX	
Chlorophyll a	XX	XX	
NUTRIENTS			
Ammonia	XXX	X	
Nitrate/nitrite	X	XXX	
ORGANIC MATTER			
TOC		X	
BOD	XXX	XX	
Major Ions			
Sodium		X	XXX
Potassium			
Calcium			X
Magnesium		X	
Chloride		X	
MICROBIOLOGICAL INDICATOR			
Faecal coliforms		XXX	XXX
Total coliforms		XXX	X
Pathogens		XXX	X

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OTHER INORGANIC VARIABLES			
Fluoride		XXX	X
Boron			XX
Cyanide	X	X	

X – XXX - Low to high probability that the grouping of the variable will be influenced and the more imperative it is to incorporate the variable in an observing system. Variables stipulated in local guidelines or standards for a specific water use should be included when monitoring for that specific use.

Source: D. Chapman [Ed.], 1996

III. ADVANCEMENT IN WATER QUALITY MANAGEMENT

3.1. MODERN APPROACH

Traditional water [21] quality monitoring involves three steps namely water sampling, Testing and investigation. These are done manually by the scientists. This technique is not fully reliable and gives no indication beforehand on quality of water. Also with the advent of wireless sensor technologies, some amount of research carried out in monitoring the water quality using wireless sensors deployed in water and sending short message to farmers about water. Also [11] research been carried out in analyzing the quality of water using machine learning algorithms too. In order to increase the reliability, flexibility and to lower the cost of water quality measurement system various advanced technologies for measuring water quality have been proposed in the recent years.

3.1.1. SENSOR BASED WIRELESS TECHNOLOGY:

A sensor based wireless water quality monitoring system is proposed in which the data from monitoring nodes is send to the base station consisting of ARM controller and then sent to the remote monitoring station and then displayed on a server PC [14].

WATER QUALITY SENSORS:

A. TEMPERATURE SENSOR:

A.1. LM 35

LM 35 is commonly used temperature sensor whose output voltage is linearly proportional to Celsius temperature. It is more accurate than thermistor. No external calibration or trimming is required to obtain exact accuracies at room temperature over range -55ºC to 150º C. It possesses low self-heating and does not cause more than 0.1º C temperature rise or fall. The output varies by 10mV with respect to every ºC rise or fall in ambient temperature which means its scale factor is 0.01V/ºC [24] [2].

A.2. DS18B20

It is a digital temperature sensor, using single bus protocol. Operating temperature range is -55ºC to +125ºC and accuracy between -10ºC~+85ºC is ±0.5º [9] [15].

A.3. PT100

PT100 sensor is a temperature dependent component. Its [21] resistance rises linearly with the temperature. Its operating temperature range is -50ºC to +230ºC. It is low weight precise temperature measuring device with ±0.5 ºC accuracy. Its nominal

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resistance is 100Ω at 0ºC and has no self-heating. It is available in 2 wire, 3 wire and 4 wire package [18].

A.4. WQ 101

WQ101 is a rugged reliable water temperature sensor that has two wire configurations for minimum current draw in which red wire is for supply and black is for output signal. Its operating temperature range is -50ºC to +100ºC with accuracy of ±0.1ºC. It operates on 10 to 36 V DC supply. It requires 5 seconds of warm up time [21].

TABLE 3: [21] Comparison of different temperature sensors

Sr.No.	Name	Operating Range	Accuracy	Applications
1	LM 35	-55 to 150ºC	±0.5 @ 25ºC	Soil & water temperature measurement
2	NTC Thermistor	-40 to 125ºC	±0.5 to ±3 @50ºC	Temperature measurement sensing & control in Industrial and Consumer electronics
3	DS18B20	55 to 125ºC	±0.5ºC @-10~85ºC	Temperature measurement which requires 9 to 12 bits of resolution
4	RTD PT100	-50 to 130ºC	±0.5ºC	Temperature monitoring control & switching in windings, bearings, machines, motors, transformers & many industrial applications
5	WQ101	-50 to 100ºC	±0.1ºC	Open water environmental monitoring applications such as stream & lake monitoring or aquaculture studies

B. TURBIDITY SENSOR

Turbidity sensor is used to measure the presence of turbidity content in water.

B.1. PHOTO ELECTRICITY

It works on phenomenon that, when light rays passed through water the amount of light scattered is equal to the turbidity of water [21]. More the suspended particles more will be light scattered that means higher the turbidity of water. Photo electricity sensor consists of LED at transmitter side and LDR at receiver side. When LED emits light the rays passes through water and scattered due to suspended particles present in water. LDR detect the scattered light rays and likewise measures the turbidity of water [11].

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B.2. TSD 10

TSD 10 sensor is used to measure the total dissolved oxygen content in water. This sensor also uses light to convey information about turbidity of water. It has [16] two horns like structure having top to bottom mono material body with a black colored cap at the bottom. The thick alloyed contact legs provide means for various connectors to hold the sensor.A white plastic slab protects the legs from damage and acts as fixture for good clamping. Outer part is covered with plastic so that it can survive high variations and mechanical abrasion. It works on 5 V.DC supply and current up to 30mA. It operates on temperature ranging from -10ºC to +90ºC [14].

B.3. TSW 10:

It is an optical sensor [21] which is used as measuring product for cloudy water density or an extra matter concentration using the refraction of wavelength between photo transistor and diode. In order to calculate the water turbidity optical transistor and optical diode is used to measurethe amount of light coming from source of light to the light receiver. It works on 5V DC supply and current max. Up to 30mA over operating temperature range of -30ºC to +80ºC [15].

A. pH SENSOR:

A pH glass probe is made up of special glass that can conduct electricity and allow only hydrogen ion. When glass probe touches the hydrogen ion the potential is produced. Likewise, different pH in water generates corresponding potential [15]. It has pH value ranging from 0 to 14. It operates on temperature range of 5 to 60ºC.The combined electrodes (glass and reference) are fitted with BNC type connector as in pH sensor module. Below the cap a hole is provided for filling the solution in internal reference electrode. It operates on 5V DC supply and current of 5 to 10mA. Its response time is 5 sec. and stability time is 60 sec. It has service life of 3 years and has analog voltage signal output.

B. CONDUCTIVITY SENSOR

Conductivity sensor circuit is same as that of photo resistor circuit. A voltage divider circuit consists of the conductivity sensor and a 10kΩ resistor which is energized by setting high digital output. Some [16] portion of 5V dropped across sensor while remaining portion dropped across the 10kΩ resistor. Voltage drop across 10KΩ resistor is measured by an analog input on ADC while voltage drop across conductivity sensor can be easily measured by making it the resistor closest to ground.

C. DISSOLVED OXYGEN SENSOR

WQ 401

It is a dissolved oxygen sensor which has three electrode structure and three wire configuration. If electrolyte deteriorates, the sensor can diagnose itself. Its temperature compensation can reach up to 25º C with output 4-20 mA. Its testing range is 0-8 ppm, accuracy is ±0.5% of full scale, and operating temperature is -40 º C to +55 º C. It is removable and easy to maintain [15].

TABLE : 4 [21] Following table shows important water quality parameters as per IS 10500-2012 standards:

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Sr.NO	PARAMETER	ACCEPTABLE	CAUSE OF REJECTION
1	Ph	6.5 to 8.5	<6.5 or >9.2
2	Odour& Taste	Unobjectionable	Objectionable
3	Turbidity (NTU)	5	10
4	Total Dissolved Solid (mg/lt)	500	2000
5	Conductivity (µS/cm)	500	1000
6	Total Hardness (mg/lt)	300	600

The system uses sensor circuitry for acquiring water quality parameters and also send this data to the controller unit. The controller unit performs necessary actions and then delivers this data to the GSM module so that the data will be sent to the monitoring center in the form of SMS [15][14][11][24][2]. Then the parameters, are sent to monitoring center by GSM network in the form of Short Message Service. It is convenient for management to take corresponding measures timely and be able to detect real-time situation of water quality remotely. The system would enable monitoring of the water quality remotely via GSM [7]. Conventional method used by aqua farms requires technical staff to visit ponds at designated time and perform manual testing on the water quality. Consequently, the technique consumes a lot of time and effort. The system also sends alert messages upon detecting degradation of water quality via SMS. The system can monitor water quality automatically, and it is low in cost and does not require people on duty. So the water quality testing is more economical, convenient and fast. The system has good flexibility.

NazleeniSamihaHaron, et.al., [17][1]This research paper proposes an architecture for implementing a water quality monitoring system for the aquaculture industry. The system monitors the water quality remotely via GSM. Conventional method used by aqua farms requires technical staff to visit ponds at designated time and perform manual testing on the water quality. Consequently, the technique consumes a lot of time and effort. This research project would focus on developing a prototype that can evaluate data collected through three criteria: Dissolved oxygen level, pH level, and temperature level. The system would also be able to send alert messages upon detecting degradation of water quality as SMS.

Mijović S, et.al., [13]This paper reports on the automatic stations for monitoring river water quality in Serbia. One automatic station observing basic parameters such as temperature, pH value, dissolved oxygen concentration and electro conductivity was established on the river Kolubara, a tributary of the river Sava.Iin addition to basic parameters there were sensors for turbidity, ammonium ion and chlorophyll. Build-up of the early warning system is in the design phase, and consists of four automatic water quality stations on

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the main watercourses – the rivers Sava, Danube and Tisa.

Wu Xiaoqing, et.al., [27]This paper reports the water quality may be an advanced term to explore. The standard of water depends on such a lot of things. We've used many thought parameters in conjunction with one another to work out the water's quality. These include turbidity, pH, total dissolved solid,conductivity and temperature. Since the standard technique of water quality measuring isn't economical thus there was a necessity to develop a system which is able to measure the standard of water in real time and also the system must be economical, correct and low price.The [13] water quality measuring system makes use of multiple sensors, information acquisition module and data transmission module. Information acquisition module includes microcontroller 8051. Data transmission module includes GSM module. There are numerous sensors that measures temperature, turbidity, pH, conductivity and total dissolved solid present in the water. This technique conjointly uses ADC. The system has the advantage of potency, accuracy and low price.

AkankshaPurohit, et.al., [1]In this paper the author describes the conventional technique of measuring the quality of water is to gather the samples manually and send it laboratory for analysis, the main drawback of this technique is time overwhelming and not economical. Since it's not achievable to take the water test to the research center after consistently to measure its quality.The system consists of multiple sensors to measure the standard of water, microcontroller and GSM to send the information to the watching center [27]. It's a genuine time framework which can interminably gauge the standard of water and can send the deliberate esteems to the watching Center. The framework depends on microcontroller 8051 and GSM. conductivity and aggregate broke down strong present in the water. This procedure conjointly utilizes ADC. The deliberate esteems are then transmitted to the watching focus by means of GSM; it's conjointly appeared on LCD by the microcontroller. The framework has the benefit of strength, precision and low cost.

Akila. U, et.al., [3]In this paper author describes an automatic wireless system to intimate the message to concerned authority when the waste water from industries are mixed with river illegally. Water pollution is a serious problem for the entire world. It threatens the health and well-being of humans, plants, and animals. The main factor of the water pollution is industries which disposes waste water to the river illegally[13]. In early project, the water pollution was detected by chemical test or laboratory test by using this system the testing equipment will be in stationary and samples will be given to testing equipment. In the Proposed water quality observing framework, the pH and Temperature sensors will be kept in the waterway. The output of all the sensors are in analog. After converting, the values are compared to the threshold value. In the event that derivation esteem above limit esteem, the robotized cautioning SMS ready will be sent to the Pollution Control Board by means of GSM.

Pradeep Kumar M, et.al., [20] In this paper author describes monitoring of Turbidity, PH & Temperature of Water makes use of water detection sensor with unique advantage and existing GSM network. The system can be expanded to monitor hydrologic, air pollution, industrial and agricultural production and so on. It has widespread application and extension value.

Now a day a wireless sensor network system is also becoming more popular which consist of high power ZigBee based technology together with the IEEE 802.15.4 compatible transceiver [29].ZigBee-based security systems are simple to install, requiring no wired connection, and easy to upgrade. Although ZigBee has a low data rate, it has still the capability to transfer images wirelessly with reasonable quality., The 802.15.4 standard uses a 128-bit Advanced Encryption Standard (AES) technology in order secure the data flow between ZigBee devices and other networks.

A patient wears a ZigBee device that is interfaced with different sensors, such as a blood pressure sensor, which gathers the information from these sensors on a periodic basis. The received information is transmitted to a ZigBee gateway.ZigBee is supposed to do what Wi-Fi or

Bluetooth which do not provide both way communication between multiple devices over a simple network using very low power and at very low cost. In proposing framework, the development of a low-cost, wireless, multi-sensor network for measuring the physicochemical water parameters; enabling real-time monitoring, is presented. ZigBee specification modules is used for wireless communication, one being used as a transmitter, whilst the other is used as a receiver.The data obtained from the sensors are processed by microcontroller and this measured values are transmitted remotely to the core controller that is raspberry pi using ZigBee protocol.

Niel Andre Cloete and et.al., [16] planned Design of Smart Sensors for Real-Time Water Quality Monitoring. In proposing framework, the development of aa low-cost, wireless, multi-sensor network for measuring the physicochemical water parameters; enabling real-time monitoring, is presented. ZigBee specification modules is used for wireless communication, one being used as a transmitter, whilst the other is used as a receiver. The microcontroller used checks if the water parameters are within safe limits. The data from the sensors is processed and analysed, and transmitted wirelessly to a notification node. The notification node informs the user as to whether the water quality parameters are normal or abnormal. If they are not, the buzzer is activated for a short period of time when the applicable parameter is displayed. The measured values are displayed on the LCD screen present in the microcontroller.

JaytiBhatt,JigneshPatoliya and et.al., planned [10] “Real Time Water Quality Monitoring System”. This paper depicts to guarantee the protected supply of drinking water the quality ought to be observed progressively for that reason new approach IOT (Internet of Things) based water quality checking has been proposed. n this paper, we exhibit the outline of IOT based water quality observing framework that screen the nature of water progressively. This system consists some sensors which measure the water quality parameter such as pH, turbidity, conductivity, dissolved oxygen, temperature. The data obtained from the sensors are processed by microcontroller and this measured values are transmitted remotely to the core controller that is raspberry pi using ZigBeeprotocol. Finally, the data can viewed on internet browser application using cloud computing.

Brinda Das, P.C. Jain entitled [5] “Real-Time Water Quality Monitoring System using Internet of Things”.This framework makes use of three sensors (pH, conductivity,temperature), processing module microcontroller, and two data transmission modules Zigbee and GSM.The microcontroller will process the digital information, analyze the information produced by the sensors.The ZigBee module in the system transfers data collected by the sensors to the microcontroller wirelessly, and a GSM module transfers wirelessly the data further from the microcontroller to the smart phone/PC. The system also has proximity sensors to alert the officials by sending a message to them via the GSM module in case someone tries to pollute the water body. This system can keep a strict check on the pollution of the water resources and be able to provide an environment for safe drinking water.

Mithila Barabde, et.al., [14]The paper addresses about developing an efficient wireless sensor network (WSN) based water quality monitoring system, which examines “water quality”, an important factor as far as, irrigation; domestic purposes; industries; etc are concerned. Water pollution can be easily detected by this system, which will help in controlling it. Overall the proposed execution of high power ZigBee based WSN for water quality monitoring system offering low power utilization and low cost is presented. Another important fact of this system is the easy installation of the system that is the base station can be placed at the local residence close to the target area and the monitoring task can be done by any person with very less training at the beginning of the system installation. Performance modelling is one important aspect in different environment to be studied in the future as different kind of monitoring application requires different arrangement during system installation

IV. CONCLUSION

Based on a study of existing water quality monitoring system and scenario of water we can say that proposed system is more suitable to monitor water quality parameters in real time. The proposed system introduces wireless sensor networking using several sensors to measure water

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quality, microcontroller and ZigBee module which make sensor network simple, low cost and more efficiently. Furthermore, to monitor data from all over the word IOT environment is provided using raspberry pi for creating gateway and also, cloud computing technology is used to monitor data on the internet. Moreover, to make system user-friendly web browser application is there. Therefore, the system will be low cost, faster,more efficient, real time and user friendly. Thus, we can fulfill aim and objective of the proposed system.

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