Water Purifier Quality Monitoring Using IOT

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***Abstract*- Water is vital resource for life. Drinking safe water is important aspect for a healthy life. In modern world water pollution is one of the major cause for various types of water-borne diseases, 40% of the deaths worldwide are caused by water pollution. The clean and safe drinking water is getting depleted every second hence water purification is todays need. World bank estimates that 21% of communicable diseases in India are related to unsafe water, contamination has been a long standing problem in our country. The older methods are unable to monitor the water quality in real time and notify the user about the contamination. So, it is necessary to develop a real time water quality monitoring and notification system. Smart solutions for water quality monitoring are gaining importance with advancement in communication technology. Water quality depends on pH, turbidity, temperature along with some other factors are significant, and will be monitored by the system using sensors, through wifi system the sensor output data is sent to concern authority for further steps to improve water quality. The proposed system is portable, automatic water quality monitoring and notification system saves time and human resources. The notification will be sent to authorized person when sensors will detect bad water quality. It is low cost system for real time water quality monitoring.**

***Index terms*- IOT, pH sensor, Turbidity sensor, Temperature sensor, UV sensor**

I.INTRODUCTION

Drinking safe water is an important factor I n our basic lifestyle as diseases occurs due to unhygienic lifestyle and so water hygiene is one of the factor that should not be overlooked. At home most people have purifiers installed. Information and communications technology systems for water control are currently facing interoperability problems due to the lack of support of standardization in monitory and control equipment. The proposed system is portable, automatic water quality monitoring and notification system, it saves time and human resources. The notification will be sent to authorised person when sensor will detect bad water quality .It is low cost system for real time water quality monitoring.

II RELATED WORK

Current water purification methods such as Reverse Osmosis and Vacuum distillation are energy consuming and cost intensive. High pressure (800 to 1180 psi) is much needed in water purification by these methods.

Membranes of Micro porous filtrations have large pore size and so they rejects only certain amount of solutes. The proposed work is to prove the utility of Nano materials in water purification. There are three basic categories of water purification technologies that are used for desalination: membrane technologies, distillation processes (thermal technologies), and chemical approaches. The Ultra clean water that is safe to drink is produced from treated water which is further purified using advanced membrane technology and ultra violet disinfection. The parameter analysis of this treated water is done with the help of IOT. Where In a nutshell, the Internet of Things refers to devices other than computers that are connected to the Internet and can send and receive data[1]

Paper [2] present a design and development of a low cost system for real time monitoring of the water quality in IOT(internet of things).The system consist of several sensors used to measure physical and chemical parameters of the water. The parameters such as temperature, PH, turbidity, flow sensor of the water can be measured. The measured values from the sensors can be processed by the core controller. The Arduino model can be used as a core controller. Finally, the sensor data can be viewed on internet using WI-FI system.[2] Microcontroller based hardware and software is designed to make existing

water purifiers IoT enabled. Designed prototype is tested and working satisfactorily. TDS value obtained from the prototype is compared with lab values obtained from environmental lab using chemical process and standard TDS meters available in the market and all the readings gave similar results.

The water TDS value and usage data is successfully uploaded to cloud server Hostinger and data is available to user by android application which is to be installed in smart phone. As the proceeding part the web server is implemented using FPGA in which a web page is hosted by flashing flash memory of the FPGA with webpage to be served.[3]The development in the automation technology has made the life easy. In present world, smart and automatic systems are being preferred over manual system. Internet has become part and parcel of human life, and Internet of Things (IoT) is the latest and emerging technology. Smart RO is a system that uses IoT technology. The proposed system has add on feature of switching the RO through Internet. The system also gives the pH value of purified water. If the obtained pH is not as per recommendations, the water is automatically directed towards the employed external module.

The external module improves the value of pH content of purified water, eventually making it healthy for drinking.[4] In[5], author offered a design and expansion of a real time water quality measuring system at reduced cost using Internet of Things (IoT). To compute the physical and chemical parameters of the water such as temperature, pH, turbidity, conductivity (Total Dissolved Solids – TDS in ppm), and several sensors were used. The centralised system receives the measured values from various sensors over a period of time. Thorough the Wi-Fi system, the sensor output data is sent to the concern authority for further steps to improve the water quality. The water quality test carried out in the samples collected from various parts of the Coimbatore district.

[5]Wireless sensor network used to measure water quality by sensing the change of pH, TDS of water after the purification process. In paper [6] wireless sensor interface with microcontroller device using two nodes of NRF24L01 one of them considered to be transmitting node while the other considered to be receiving node. The status of system will send to Web with IP defined address in order to monitor the status of system numerically and graphically. The esp8266 module has been used because it is allowing microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections with wireless sensor network.[6] In paper[7] they design and develop a low cost system for real time monitoring of the water quality in IoT.

At present, water parameters are detected by chemical test or laboratory test, where the testing equipments are stationary and samples are provided to testing equipments. Thus the current water quality monitoring system is a manual system with tedious process and is very time consuming. In order to increase the frequency, the testing equipments can be placed in the water resources and detection of pollution can be made remotely. This paper proposes a Sensor-Based Water Quality Monitoring System which is used for measuring physical and chemical parameters of the water. The parameters such as Temperature, pH, TDS and Turbidity of the water can be measured.

The measured values from the sensors can be processed by the core controller. The Raspberry Pi model can be used as a core controller. Finally, the sensor data can be viewed on internet using ThingSpeak API. The uniqueness of our proposed paper is to obtain the water monitoring system with high frequency, high mobility, and low powered.[7] OPC UA (Object Linking and Embedding for Process Control Unified Architecture) is a platform independent service-oriented architecture for the control of processes in the logistic and manufacturing sectors. Based on this standard we propose a smart water management model combining Internet of Things technologies with business processes coordination and decision support systems. We provide architecture for sub-system interaction and a detailed description of the physical scenario in which we will test our implementation, allowing specific vendor equipment to be manageable and interoperable in the specific context of water management processes.

[8]The older method was unable to monitor the water quality in real time and notify the users about the contamination. So, it is necessary to develop a real time water quality monitoring and a notification system which gives effective result and save the precious health of human being by alerting them in real time. Water quality depends on PH, turbidity,

temperature along with some other factors are significant.

A traditional method consists of collecting water sample manually and then send to laboratory for testing. It takes so much time without providing result in real-time. The existing system has a mechanism which are semi-automated or manually controlled devices which are to be handled by a person responsible for monitoring the water quality. The instruction or tools are used either putting or inserting a water sensing part into water and seeing the result on small display device or by directly inserting a portable device in water and observing the output on the display. The objective of this system is to develop a real time system for assessment of fully automated portable water quality. It reduces human effort, covers a large area efficiently. This system consists of different type of sensors, notification module consists of LCD display, Wi-Fi device and Arduino.

The portable and automatic water quality monitoring and notification system saves time and human resources. The notification will be sent to the authorized person when sensor will detect bad water quality and if any user wants to know the current status of the water.[9]

Paper[10] presents a detailed overview of recent works carried out in the field of smart water quality monitoring. Also, a power efficient, simpler solution for in-pipe water quality monitoring based on Internet of Things technology is presented. The model developed is used for testing water samples and the data uploaded over the internet is analysed.

The system also provides an alert to a remote user, when there is a deviation of water quality parameters from the pre-defined set of standard values.[10] This paper is based on UV water purifier and its communication to service centre when it is disfunctional. The UV sensor used in this project is a add on feature .This project also helps in monitoring the turbidity and pH level which can be useful in future for further modification. The project keep monitoring on the functioning of water purifier and when the purifier gets out of service it automatically communicates to the service centre in order to inform about the same.

In this way, the user do not need to have attention on the system hence time will be saved and the service centre would immediately get the information regarding the purifier and could visit it to repair. The project implements this idea using Raspberry Pi controller, pH sensor, UV sensor, LCD, GSM and software tools.

III METHODOLOGY

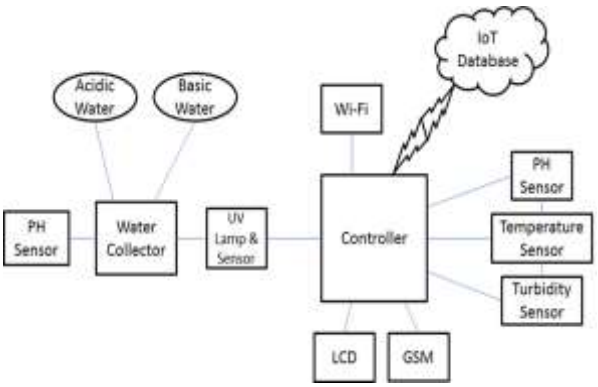

Figure: Block diagram

In this system, modifications in general aqua guard system have been made for real time water quality monitoring and notification. UV sensor is used to check the working of UV lamp. UV lamp emits UV rays, which is used for water purification along with other forms of filtration such as reverse osmosis systems or carbon block filters in water purifiers. However the working of this UV lamp is not indicated in the purifiers we use.

Hence UV sensor will ensure the proper working of the lamp. pH of the water needs to be neutral as multiple health issues arise due to consumption of acidic water, as acidic water consist of iron, copper etc , too much exposure to these metals leads to illness and poisoning. pH sensor will check the pH of the water in the collector and make it neutral by adding acidic or basic water into it. pH value of neutral water is 7. The normal range of pH is 6 to 8.5 .Temperature sensor will check for the temperature and turbidity sensor will check the turbidity of water. The sensor output will be displayed on the lcd for real time monitoring and in case of failure in the system notification will be sent to the service centre. It will ensure the efficient working of the water purifier.

pH sensor: The pH of a solution is the measure of the acidity or alkalinity of that solution. The pH scale is a logarithmic scale whose range is from 0-14 with a neutral point being 7. Values above 7 indicate a basic

or alkaline solution and values below 7 would indicate an acidic solution. It operates on 5V power supply and it is easy to interface with arduino. The normal range of pH is 6 to 8.5

Figure: pH sensor

Turbidity sensor: Turbidity is a measure of the cloudiness of water. Turbidity has indicated the degree at which the water loses its transparency. It is considered as a good measure of the quality of water. Turbidity blocks out the light needed by submerged aquatic vegetation. It also can raise surface water temperatures above normal because suspended particles near the surface facilitate the absorption of heat from sunlight.

Figure: Turbidity sensor

UV Sensor: UV sensors measure the power or intensity of incident ultraviolet (UV) radiation. It is used for determining exposure to ultraviolet radiation in laboratory or environmental settings. They are transmitters that respond to one type of energy signal by producing energy signals of a different type. UV phototubes are radiation-sensitive sensors that are used for monitoring UV air treatments, UV water treatments, and solar irradiance. Light sensors are general-purpose devices for measuring the intensity of incident light.

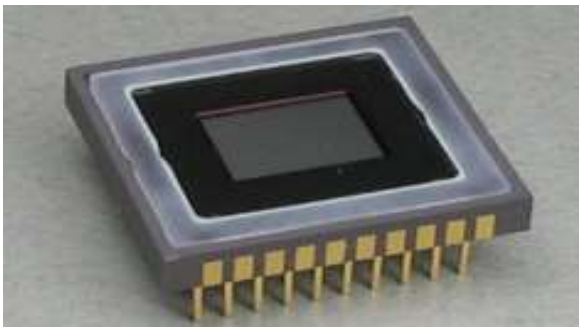

Figure: UV Sensor

Temperature Sensor: The DHT11 is a commonly used Temperature and humidity sensor. The sensor comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data. The sensor is also factory calibrated and hence easy to interface with other microcontrollers.

Figure: Temperature Sensor

Raspberry pi processor: It is a Minicomputer, Usually with a Linux OS to run multiple programs. Raspberry pi has the built in Ethernet port, through which you can connect to the network. Raspberry pi is shown in Figure .But to starts with Pi you don't need dive into the loading language and a small knowledge of electronics and its component is enough.

Figure: Raspberry pi

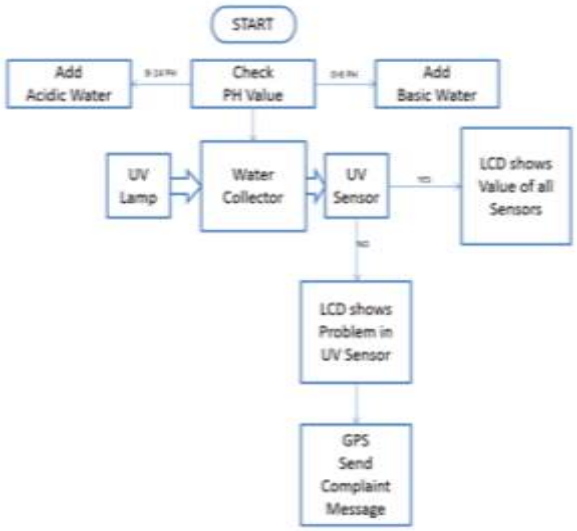

Figure: working flow

IV RESULT

This paper focus on analysing the water quality with high performance, real time and accuracy. In our proposed system we have measured Temperature, Turbidity and pH values of water with the help of various Sensors. And monitored the working of UV lamp. The output of the sensors is shown on lcd and in case of failure of system notification is sent to the authorised person. In future, the parameters like conductivity, hardness, chloride, ammonia, iron, fluoride etc. also can be monitored by using corresponding sensors and changing appropriate python programs. The system can monitor water quality automatically, and it updates the parameter details automatically to the authorised person. The proposed water quality testing has to be more cost-effective, suitable and rapid. The system has good flexibility. The operation is simple. The system can be prolonged to examine hydrologic, air pollution, industrial and agricultural fabrication and so on. So, this application will be the best challenger in real time monitoring & control system and use to solve all the water related problems. An efficient, real time water quality monitoring system based on IoT is presented. The UV sensor used is the most useful feature as the working of UV lamp is not checked in any known system. Proposed system monitors the working of water purifier. The range of pH value for drinking water is observed to be 6-8.

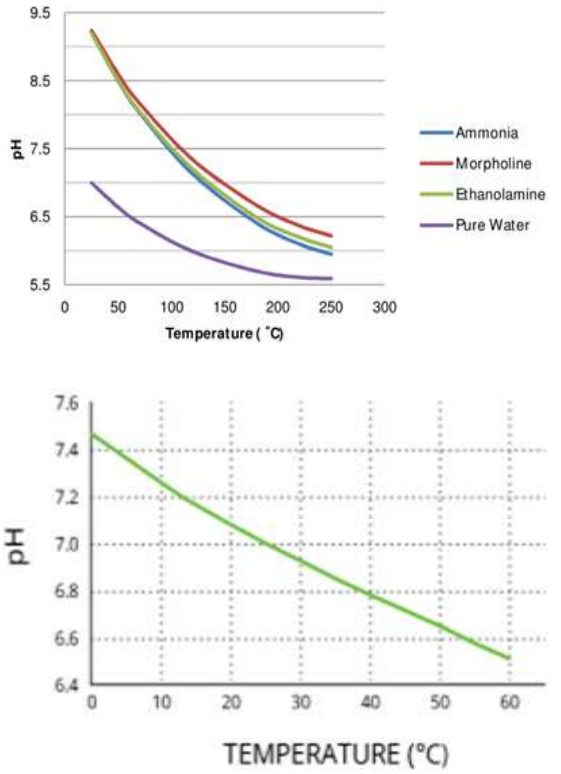

Figure: Graph of pH versus temperature

V CONCLUSION

In this project we connected water purifier to internet, and achieved real time water quality monitoring and notification system with the help of temperature sensor, turbidity sensor, pH sensor, UV sensor and raspberry pi. The older methods are unable to monitor the water quality in real time and notify the user about the contamination. So, it is necessary to develop a real time water quality monitoring and notification system for the users, to control water borne diseases. Proposed system will not only monitor the quality of water but also monitor the working of water purifier. The monitoring of working of water purifier is necessary and it is not present in the current system. Hence the project is low cost advancement in the current available systems for water purification. The components used are easily available and low cost. The proposed system saves time as well as human resources and ensures proper working of the water purifier.

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