Water Quality Testing and Monitoring System

N. Thirupathi Rao, Debnath Bhattacharyya, V. Madhusudhan Rao, Tai-hoon Kim

Abstract: ***Traditional methods of drinking water quality parameters like turbidity, pH, conductivity and temperature etc., may consume time as samples are tested manually in the laboratory. To overcome this, in the current article an attempt has been made for developing the smart and low-cost IoT system. The parameters considered to test the quality of water are Temperature, Turbidity, pH, Conductivity. Sensors immersed in sampled water are used to measure the above said parameters. The sensed data from the sensors was sent to the Raspberry Pi Unit. The sensed data parameters compared with the standard values which already exist in Raspberry Pi Unit. The data stored in Raspberry Pi accessed from the IOT (cloud). If any change in the standard values was observed, a message or a mail will be sent to the Smartphone through Wi-Fi. In the current work, samples of water were collected to test the purity of water. Also to check the variety of particles those were present in the water. In this work, we use sensors for testing purity of water. The current developed model will detect the particles that are present in the water and also the level of purity in the water. The results were displayed in the form of the numerical values at the display unit that was fixed on the IoT unit.***

Keywords: IoT, Water Quality, PH Value, Water control.

I. INTRODUCTION

The Internet of Things (IoT) is a plan of combining devices belongs to various areas like mechanical and propelled machines are used to enable novel identifiers and to trade data over a framework without anticipating the personnel computer association[1,3]. IoT had created from the gathering of remote developments, scaled down electromechanical structures (MEMS), small-scale organizations and the web. Pv6's large addition in address space is a primary factor in the progression of the IoT. A development in the number of sharp centers and likewise the measure of upstream data centers make is depended upon to raise new stresses over data insurance, data influence and security [2,4]. Practical employment of IoT development can be found in various ventures today, including precision cultivating, building the organisation, restorative administrations, essentialness and transportation. The product designers could connect with the device over the web, check the status of the developed model and choose if there would be any cold drink suspecting them, should they make the trek down to the machine [6].

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N. Thirupathi Rao, Department of Computer Science and Engineering Vignan's Institute of Information Technology (A)Visakhapatnam, AP, India.

Debnath Bhattacharyya, Department of Computer Science and Engineering Vignan's Institute of Information Technology (A) Visakhapatnam, AP, India.

Tai-hoon Kim, Department of Convergence Security, Sungshin Women's University, Seoul, Republic of Korea (South Korea)

V. Madhusudhan Rao, Department of Chemical Engineering, Vignan's Foundation for Science, Technology and Research (Deemed to be University), Vadlamudi, Guntur-522213, India.

A. Characteristics of the Embedded Systems

Two significant regions of differentiation are cost and usage of electricity. Since various embedded structures are conveyed in few thousands to many runs, reducing cost is a vital concern. Embedded structures often use a (by and large) direct processor and little memory size to confine expenses [5]. The progressiveness isn't just clock speed. The whole building of the PC is routinely deliberately enhanced to cut down costs. Various previously introduced structures often live in machines that are depended upon to run continuously for a year without botches and once in a while recover autonomously from any other individual if a bumble happens [4]. Like this, the item is by and large made and attempted more meticulously than that for PCs and dangerous mechanical moving parts for instance circle drives, switches are avoided. Specific resolute quality issues may include as follows,

1. The system must be kept running for prosperity reasons. As often as a director picks possible fortifications. Delineations in the IoT models are join aircraft course, reactor control systems, essential security compound assembling plant controls, etc.
2. The system will lose a considerable measure of money when shutting down like: Telephone switches, preparing plant controls, framework and lift controls, save trade and market making, robotized arrangements and the organisation.
3. A combination of strategies used rarely in the blend to recover from bumbles like programming bugs, memory spills, and moreover fragile slip-ups in the hardware.
4. The watchdog clock that resets the PC unless the item irregularly tells the protect pooch subsystems with additional abundance items that can be changed over to programming "limp modes" that provides a central limit.
5. Designing with Trusted Computing Base (TCB) outlining assurances a significantly secure and robust structure condition.
6. A hypervisor expected for embedded structures can the give secure epitome to any subsystem portion so that an exchanged off programming part can't intrude with various subsystems, or advantaged level system programming. This representation shields issues from inducing beginning with one subsystem then onto the improving steady quality. This may moreover empower a subsystem to be shut down and restarted on accuse distinguishing proof.

B. Introduction to Micro Processors and Micro Controllers

A microchip is a PC processor which combines the components of a PC's Central Processing Unit (CPU) on a singular Integrated Circuit (IC) or at most two or three facilitated circuits. The microchip is a multipurpose, the clock driven, enlist based, progressed a consolidated circuit which recognizes parallel data as information, frames it according to bearings secure in its memory and gives to fruition as yield. Microchips contain both combinational justification and following propelled reason. Chip deal with numbers and pictures addressed in the twofold numeral system. The model diagram of the circuit was shown in the below figures as follows,

Micro Processors Examples:

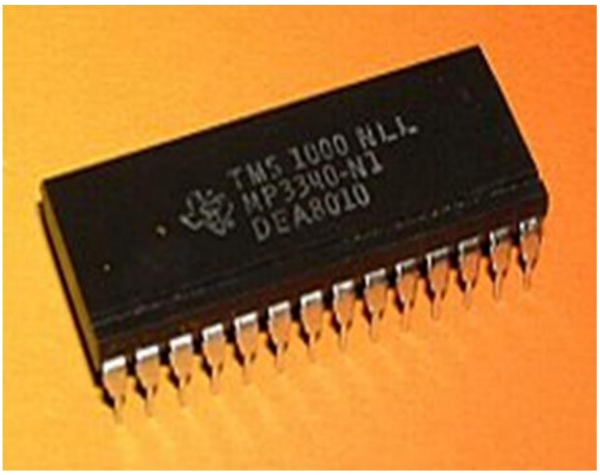

Fig 1. Texas Instruments TMS1000

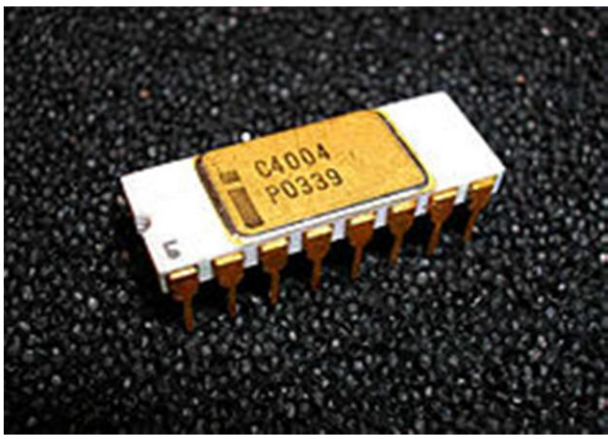

Fig 2. Intel 4004

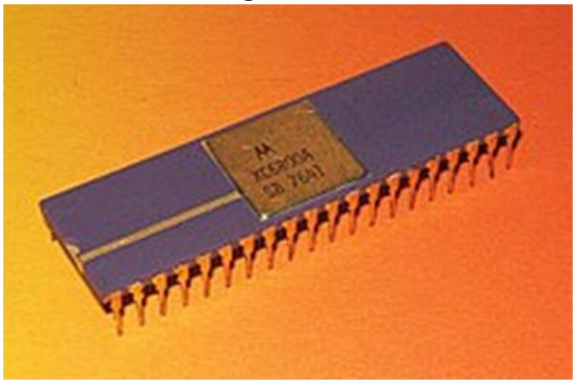

Fig 3. Motorola 6800

The coordination of a whole CPU onto a lone chip or on two or three chips unimaginably diminished the cost of getting ready to power for growing profitability. Combined circuit processors are conveyed in enormous numbers by mainly automated systems realising a low for each unit cost. Single-chip processors increase steady quality as there are various less electrical relationships with unit fails. As microchip plots hint at change, the cost of amassing a chip, (with more small sections given a semiconductor chip a comparable size) all things considered continues as before. Before chip, small PCs had been produced using racks of circuit sheets with various medium-and small-scale facilitated circuits. Chip solidified this into one or two or three immense range ICs. Continued with increases in microchip restrain have since rendered diverse sorts of PCs utterly outdated (see a history of enlisting gear), with not less than one chip used as a piece of everything from the smallest embedded structures and handheld devices to the highest incorporated servers and supercomputers.

C. Microcontrollers used in the Traffic Monitoring Unit

8051 Microcontroller is one of the mostly used microcontrollers that were available in the market today for the usage of various types of users for various set of applications. Due to the more applications size and heavy usage and various set of instructions and further more sizes that supported by the microcontroller was the reason. This microcontroller was available in three sizes in the market today. Those sizes are Short, Standard, Extended. It has 4 KB chip program memory. It has 128 bytes RAM, 4 register banks, 16-bit address bus, 16 bit timers, four 8-bit ports and 16-bit program counter and data pointer.

Light Emitting Diode (LED): A light-transmitting diode (LED) is a semiconductor diode that transmits jumbled close range light when electrically uneven the forward method for the open crossing point as in the standard LED circuit.

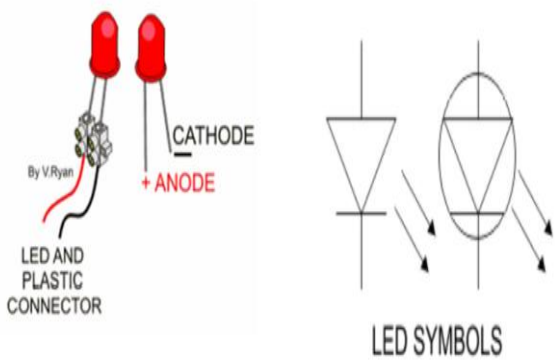

Fig 4. Light Emitting Diode

Advantages:

1. LEDs have many preferences over different advancements like lasers.
2. LEDs have few points of interest over ordinary lights.

3. The principle advantage is effectiveness. In regular globules, the light creation process includes producing a great deal of warmth. This is squandered vitality unless you're utilising the light as a warmer because, a large segment of the available power isn't going toward delivering noticeable light.
4. LEDs produce almost no warmth. A significantly higher level of electrical power is going specifically to creating light which eliminates the power requests impressively.

BCM2835 Block Diagram:

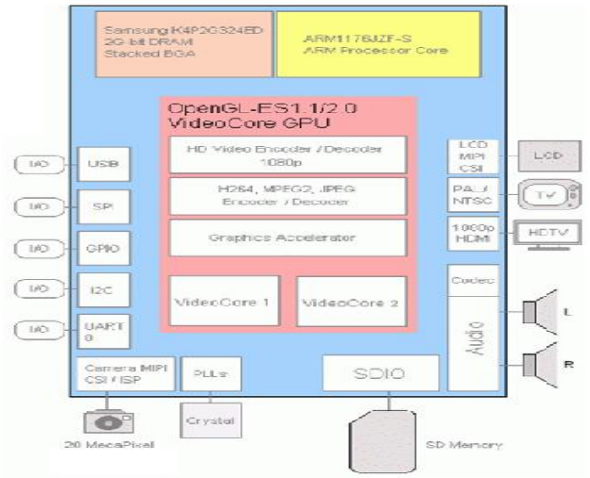

Fig 5. BCM2835

II. EXISTING SYSTEM

Drinking water faces many challenges in the current situation due to growing population and pollutants from industries, agriculture waste etc., are mixed with drinking water. Traditional methods to test drinking water quality parameters like turbidity, pH, conductivity and temperature etc., may consume time because, samples are tested manually in the laboratory. Also, there has been the coding insurgency in Raspberry Pi. Raspberry units working with normal coding also created so much of the slow operation of the unit.

III. PROPOSED SYSTEM

To overcome these above said problems, a smart and low-cost system for real-time monitoring of water quality by using the IoT, which provides global testing using Python programming model was designed and developed. The parameters considered to test water quality are Temperature, Turbidity, pH and Conductivity etc. Sensors immersed in sampled water measure the settings. The sensed data was sent to the Raspberry Pi. The sensed data parameters compared with the standard values which already exist in Raspberry Pi. The data stored in Raspberry Pi accessed from the IOT (cloud).

IV. METHODOLOGY AND RESULTS

One of the current advancing figuring innovations has been the creation of the Raspberry Pi. As an aftermath, there has been the coding insurgency. This article is the preliminary for coding on the raspberry pi. In this article, programming on the Raspberry pi utilizing a standout among the most common dialects on the planet taken as the python. Python prescribed dialects that are simple for newcomers for the program. In the current proposed technique, the centre controller for getting information is raspberry pi. The raspberry pi keeps running on python by connecting to console and screen the python is stacked on to the raspberry pi where the temperature sensor, pH sensor, conductivity sensor and turbidity sensors can be used straightforwardly from the charge line.

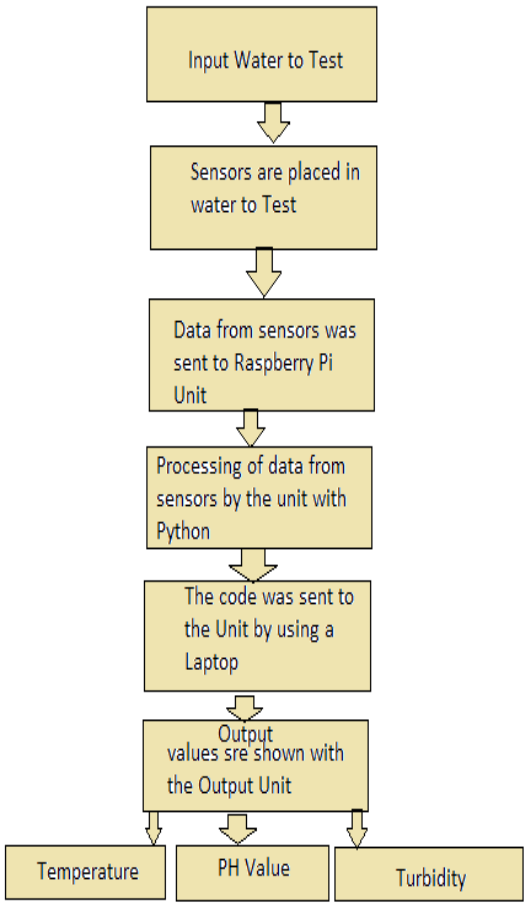

Fig.6 Proposed Model working flow block diagram

Python dialect utilized which will read the sensor esteem consequently. The raspberry pi sends the information to the IOT module. IOT module sends the data to the web employing WI-FI for getting to a cell phone.

Fig 7. IoT Model developed for calculating the Water Quality

To verify the performance of the developed model, the authors had tried to check the model with a various set of waters. One of the most critical scenarios for testing the quality of water decided was drinking water. It is essential because, it is directly connected or linked with humans or the general public. If the water contaminated with various particles and the water that was taken by the people, especially the children, they may be prone of getting or attacking multiple severe diseases like diarrhea and other infections and other severe disorders. It had implemented and the results taken from various sources and the water were tested and the results are shown in the images with circuit designs and diagrams and the results.

Fig 8. Drinking water Temperature and pH Values

Fig 9. Drinking water Turbidity Value

Final results for drinking water are as follows **pH**: 05, **Temperature**: 29, **Turbidity**: 05 and this water is good for drinking.

V. RESULTS AND DISCUSSIONS

Various other types water is collected from various sourced and tested for the same proposed model and values are tabulated in the below table 1 as follows,

Table I. Various types of water tested and their corresponding values

S. No.	Type of Water	Temperature	pH Value	Turbidity
Case 1	Drinking water	29^0C	05	05
Case 2	Mud Water	31	07	05
Case 3	Tap Water	30	7.4	06
Case 4	Sea Water	27	7.9	06
Case 5	Distilled Water	28	5.6	05
Case 6	Water filter water	29	7.3	06
Case 7	Water bottled water	28	7.1	4.5

The pH value for various types water collected from various sources was tested and results are displayed in the table 1. The temperature of the water from various sources and the other parameter turbidity of the water also displayed in the table 1. From the above table, it is observed that the pH value of sea water and filter water is higher and the temperature of the mud water is high when compared to other types of waters. The turbidity of filter water is high and the bottled water is having very less when compared to the other types of waters.

VI. CONCLUSIONS

Water quality monitoring is the low-cost system and used by the people who are concerned about water. The water quality parameters like turbidity, pH, temperature, turbidity and conductivity can be calculated or identified by using different water sensors with one of a kind in existent network IoT. The detailed water quality parameter can be monitored automatically, which were low in cost and doesn't require many hands and the time consumption will be comparatively small. In the current proposed system, security plays a significant role because of the usage of the cloud server. Therefore, we have username and password to use the current developed model to observe the performance. Observing of Turbidity, PH and Temperature of water makes utilization of water identification sensor with one of a kind preferred standpoint and existing GSM arrange. The framework can be extended to screen hydrologic, air contamination, mechanical and agrarian creation etc. It has great application and augmentation esteem. The above-presented project was successful in monitoring the water quality parameters. It minimizes the laboratory equipment that would need for the traditional way of testing the water for its quality. The primary point is we have been able to record all the details obtained in our testing in the cloud. The results can view and fetch whenever required.

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AUTHORS PROFILE

Dr Debnath Bhattacharyya received PhD (Tech., CSE) from University of Calcutta, Kolkata, India. Currently, Dr Bhattacharyya associated with Vignan’s Institute of Information Technology, Visakhapatnam-530049, India as Head of Computer Science and Engineering and Dean R&D of the Institute since the year 2015. His research areas include Image Processing, Pattern Recognition, Bio-Informatics, Computational Biology, Evolutionary Computing and Security. He published 200+ research papers in various reputed International Journals and Conferences. He published six textbooks for Computer Science as well. He is the member of IEEE, ACM, ACM SIGKDD, IAENG, and IACSIT.

Dr Tai-hoon Kim received B.E., and M.E., degrees from Sungkyunkwan University in Korea and PhD degrees from University of Bristol in UK and University of Tasmania in Australia. Now he is working for Department of Convergence Security, Sungshin W. University, Korea. His primary research areas are security engineering for IT products, IT systems, development processes, and operational environments. He published 400+ research papers in various reputed International Journals and Conferences. He published ten textbooks for Computer Science as well. He is the member of IEEE, ACM, etc.

Dr N. Thirupathi Rao received PhD (Tech., CSE) from Andhra University, Visakhapatnam, India. Currently, Dr N.Thirupathi Rao associated with Vignan’s Institute of Information Technology, Visakhapatnam-530049, India as Associate Professor and Asst. HoD of Computer Science and Engineering of the Institute since the year 2016. His research areas include Communication Networks, Queuing Models, Stochastic Modeling, Image Processing, Pattern Recognition, Bio-Informatics, Evolutionary Computing and Security. He published 45+ research papers in various reputed International Journals and Conferences. He is the member of ACM, IE, CSI, and ISPS.