Monitoring the Water Eminence using Distributed System in an IoT Environment

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Abstract- -- **In order to ensure the safe supply of the drinking water the quality needs to be monitor in real time. This paper presents the different methodologies implemented in an IoT environment to ensure pure and quality drinking water. The systems proposed consist of several sensors which are used to measuring physical and chemical parameters of the water. The parameters such as TDS, pH, Dissolved solids, total hardness, suspended particles and dissolved oxygen of the water can be measured. The measured values from the sensors can be processed by the core controller. The different technologies which are used consist of CoAP, XMPP, HTTP and Raspberry PI. Finally, the sensor data can be viewed on internet using cloud computing.**

Keywords- Water Quality Monitoring, Internet Of Things, TDS, Cloud Computing.

I.INTRODUCTION

Nowadays drinking water is the most precious and valuable for all the human beings, drinking water utilities faces new challenges in real-time operation. This challenge occurred because of limited water resources growing population, ageing infrastructure etc. Hence therefore there is a need of better methodologies for monitoring the water quality

Traditional methods of water quality involve the manual collection of water sample at different locations, followed by laboratory analytical techniques in order to character the water quality. Such approaches take longer time and no longer to be considering being efficient [1]-[5]. Although the current methodologies analysis the physical, chemical and biological agents, it has several drawbacks: a) poor spatiotemporal coverage b) it is labor intensive and high cost (labor, operation and equipment) c)the lack of real time water quality information to enable critical decisions for public health protection. Therefore, there is a need for continuous online water quality monitoring.

The online water monitoring technologies have made a significant progress for source water surveillance and water plant operation. The use of these technologies having high cost associated with installation and calibration of a large distributed array of monitoring sensors. The algorithm proposed on the new technology must be suitable for particular area and for large system it is not suitable

By focusing on the above issues this paper describes an overview of different methodologies which were developed to monitor and the analyses the water quality in real-time IoT environment. In the survey the technologies which are used consists of core controller. The design system applies a specialized IoT module for accessing sensor data from core controller to the cloud. The sensor data can be viewed on the cloud using a special IP address. Additionally the IoT module also provides a Wi-Fi for viewing the data on mobile.

The rest of this paper is organized as follows: In section II, shows the relation with IOT. In Section III, shows the overall flow diagram of the proposed method and its corresponding explanation. In Section IV shows the performance analysis and their corresponding result obtained is present. In Section V shows the conclusion of the proposed system.

II.THE RELATION WITH IOT

The internet has changed all the human lives in past decades. An IoT becomes a foundation for connecting things, sensors and other smart technologies. IoT is an extension of the internet of things [6]. IoT gives an immediate access to information about physical objects and leads to innovative service with high efficiency and productivity [7]. There are several important technologies related to the IoT are ubiquitous computing, RFIP, wireless sensor network, cloud computing.

Cloud computing is a large- scale, low cost processing unit, which is based on the IP a connection for calculation and storage.The characteristics of the cloud computing has been discussed. The IoT application areas include home automation, water environment monitoring, and water quality monitoring etc. the water quality monitoring application involves large distributed array of monitoring sensor and a large distribution networks [8],[9],[10]. It also requires separate monitoring algorithms as reviewed. In the system suggested method, they introduced a cloud computing technique for viewing sensor values on the internet. The rest of this paper is organized as follows. The Smart Water Quality Monitoring System will measure the following water parameters for analysis; Potential Hydrogen (pH), Oxidation and Reduction Potential (ORP), Conductivity and Temperature using a RS technology[5]. While monitoring these parameters, it is perceived that one should receive a stable set of results. Therefore a continuous series of anomalous measurements would indicate the potential introduction of a water pollutant and the user will be notified of this activity with the aid of IoT technology [9]. False positives, such as anomalous readings over a short period of time, will be recorded but not treated as an alert [12] and [13]. Hence, with the successful implementation of this monitoring approach, a water pollution early warning system can be achieved with different methodologies.

III.PROPOSED SYSTEMS

The Smart Water Quality Monitoring System will measure the following water parameters for analysis; Potential Hydrogen (pH), Oxidation and Reduction Potential (ORP), Conductivity and Temperature using a RS technology. While monitoring these parameters, it is perceived that one should receive a stable set of results [1]. Therefore a continuous series of anomalous measurements would indicate the potential introduction of a water pollutant and the user will be notified of this activity with the aid of IoT technology [11] . False positives, such as anomalous readings over a short period of time, will be recorded but not treated as an alert. Hence, with the successful implementation of this monitoring approach, a water pollution early warning system can be achieved with the accurate sensor systems and the different methods which will detect the impurities in water.

Libeliums Smart Water device monitors the status of an aquarium's health in Europe. It specifically monitors parameters like pH, electro conductivity, oxidation/reduction potential (ORP) and temperature. A cloud based solution is developed to help in monitoring data in real time providing a fast and effective reaction in case of rising abnormalities up on 80-processor and also it gives an average of 10 times improvements over unidirectional search for the eight puzzle problem[7].

A similar example to that of this project can be seen in the coastal water pollution monitoring initiative in the Gulf of Kachchh with the only difference being in terms of it having a much larger scope and vastly more expensive protocols deployed to counter the effects of the industrial development.

Furthermore, locally there have been projects based around the conservation of the coral reefs [6]. The Mamanuca Environment society's (MES) Biannual Sea Water Monitoring Program has been around for 4 years whereby tests are carried out on seawater for faecal coliform (FC) bacteria, salinity and nutrients which helps in ascertaining the health of the surrounding reefs [8].

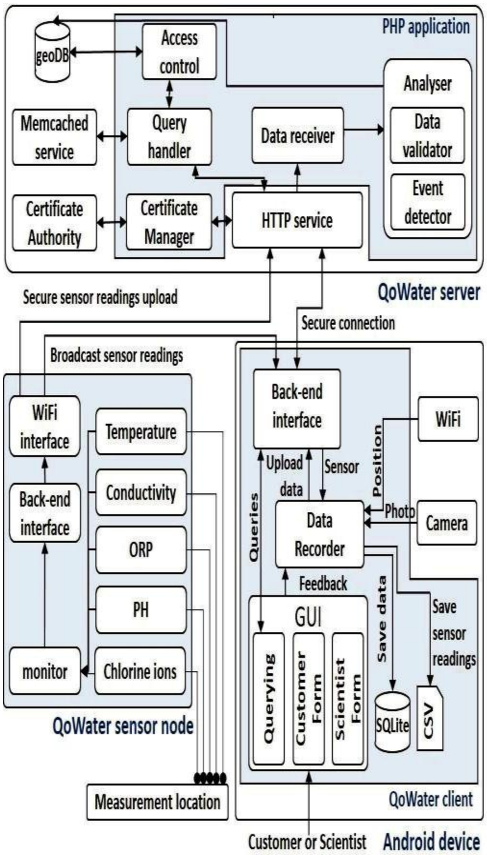

Fig. 1: The QoWater system architecture.

The QoWater system consists of three components, namely, the QoWater server, clients, and sensors (Fig. 1). The QoWater client includes a back-end interface, data recorder, database, and its GUI. The querying allows a user to enquiry about the quality of water in a specific area and time period. Users can adopt two different roles, namely, the customer role and scientist one with different registration and access requirements. Customers indicate their age and gender, and optionally their name, while Scientists in addition provide information about their profession and their e-mail address. Standard technologies (e.g., public-private key pairs, TLS) are employed to ensure registration and integrity for the client server communication. Standard technologies (e.g., public-private key pairs, TLS) are employed to ensure registration and integrity for the client-server communication. A non-register QoWater client is not authorized to query and submit feedback. Depending on the role, different questionnaire forms are used via the GUI for the assessment of the water quality (Fig.2 and Fig 3). The customer form provides fields for overall evaluation score, color, taste, odor, appearance, and pressure. A photo captured by a *camera* may also be attached to the customer input. On the other hand, the Scientist form prompts users to insert chemical and biological measurements, as well as information about color, appearance, and pressure assessment.

The recorded information may be directly uploaded on the QoWater server or saved locally. Moreover, this information is annotated with the current location of the device, provided by the Wi-Fi localization and timestamp. Without the localization being enabled, the measurements cannot be uploaded. The SQLite database maintains a log of the feedback. The back-end interface includes a secure Hypertext Transfer Protocol (HTTP) client for connecting to the QoWater server. Furthermore, the back-end interface captures broadcast messages from QoWater sensors.

IV. PERFORMANCE ANALYSIS

This section focuses on the evaluation of the response delay, battery consumption, and scalability, which are critical aspects of the system. The client is an HTC Nexus One smartphone. The QoWater server runs on a virtual machine (VM) with 2 cores at 2.4 GHz, 4 GB RAM [2]. To measure the power consumption of the QoWater client, we use the AppScope with tool, an energy metering framework for Android OS using kernel activity monitoring. The App-Scope estimates the energy consumption per hardware component (e.g., CPU, Display, Global Positioning System (GPS), WiFi, 3G), as well as per process. Other approaches, such as Power Scope , provide the energy consumption of applications at a fine-grained level but require post-processing using an external device. For example, Power Tutor [2] that accesses usage statistics from *profcs and* Battery Stat, built-in Android operations, to provide application-specific energy information, but this approach has several limitations affecting the accuracy. We use the same test bed for the power consumption estimation as the one of the u-mapping systems. The flow and the feasible solution. If feasible solution is given its cost is calculated and it is stored as cost_temp. After all neighbors are evaluated the best cost is found and chosen [13]. The main advantage of this method is the CPU time that is large problem size can be handled at the cost of solution quality.

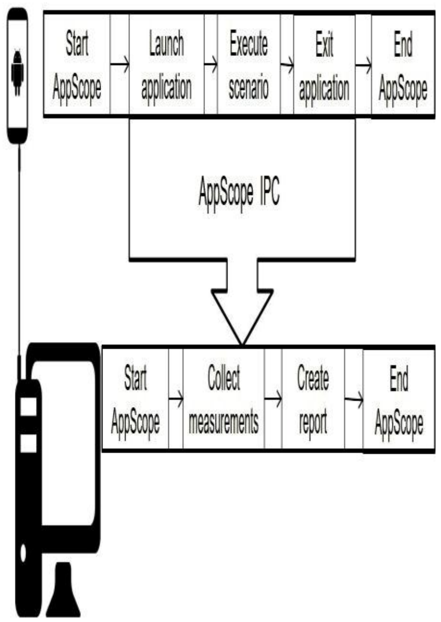

Fig 2.The QoWater test bed for the power consumption .

Fig 3.Proposed system for smart water analysis in an IoT Environment

The internet of Things (IoT) is a revolutionary new concept that has the potential to turn virtually anything "smart". A Thing in this context could be defined as an object such as a cardiac monitor to a temperature sensor. This extraordinary event has captured the attention of millions. Why is this so big today? So imagine a world where machines function without any notion of human interaction [6]. A future where machines communicate with other machines and make decisions based on the data collected and all independent of an end user.

To understand how this revolution took shape we have to travel back to the 1900's with a profound prediction from a well renowned inventor Nicolai Tesla in which he stated that the world will be wirelessly connected to a single brain. Every invention starts with a simple thought, that's all it takes to define history. Alan Turing, the inventor of the computer, spoke about machines having sensors and humans teaching the machines, what we know today as Artificial Intelligence (AI).). Then came the World Wide Web (www), the flow of information that is available to the public and this was exactly what was missing to realise Teslas prediction. The term itself "internet of things" was coined in 1999 by Kevin Ashton for linking the idea of sensors with the internet [5]. The IoT journey has taken over a century to see light and it will undoubtedly not stop here.

V CONCLUSION

This survey demonstrates a smart water quality monitoring system. Four different water sources were represented which may take the duration of 12 hours at hourly intervals to validate the system measurement accuracy. The water monitoring systems mentioned in the paper will be so accurate as compared with one another different techniques mentioned above. The temperature relation with pH and conductivity were compared for all the water samples with the values corresponding to the predefined values as shown in performance analysis. GSM technology has been successfully implemented to send alarm based on reference parameter to the ultimate user for immediate action to ensure water quality. Additionally, the parameter references obtained from all the different water sources will be used to build classifiers which will be used to perform automated water analysis in the form of Neural Network Analysis.

In a nutshell, the different systems with various technologies has proved its worth by retaining accurate and consistent data throughout the system implementation and with the added feature of incorporating IoT platforms for real time water monitoring, this might be an excellent contender in real time water monitoring solutions.

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