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Implementation of Multifunction Integration Module for Water Quality Measurement

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Abstract

Objectives: Currently, according to the industry due to home, industrial, sewage used in various types of facilities can pollute the water directly and indirectly. Thus, the new service to determine the safety of the user himself water is absolutely necessary. In this paper, we designed and implemented an integrated quality measurement module in order to develop an automatic water quality measuring system. **Methods/Statistical analysis:** To this end, we implement the pH sensors, dissolved oxygen sensors, conductivity sensors, four sensors is a water meter integrated entry of the temperature sensor. **Findings**: In this paper, we want to develop an automatic water quality measuring system with integrated sensor module. To this end, pH sensors, conductivity sensors, ORP sensors, temperature sensors developed a module integrating sensor. The basic structure of the instrument was composed motherboards to feature that in general the data sent to the smartphone as a versatile and integrated sensor module. Through this, we developed an integration module to validate all information measurement results, regardless of water quality only by a simple application of a portable meter with a smartphone in real time and place. **Improvements/Applications:** In this paper, we developed an integrated water quality measurement data from the sensor module to receive further technology transfer to smart devices. In addition, by utilizing the measured data, we designed an algorithm for water quality analysis, and calculation results.

Keywords: Conductivity Sensor, Integration Module, pH Sensor, ORP Sensor, Temperature Sensor Water Quality Analysis Algorithms

1. Introduction

Currently, the water has been used in various forms such as water supply, sewage, industrial, equipment market. According to the National Water Information System statistics, the total water consumption in the years leading quantities of 2011 shows the 4,990 million m³, home to 3,160 million m³, 1,259 million m³ for the purposes of a business, and for industrial use 146 million m³. As a result, per capita water consumption is the result came

out of 279L.In addition, the population being supplied as services by businesses is ten thousand people from 9,300 to 1988 year the average annual rise of 29.7% in 2005 year is 56,620 million people or 9% of the world's population. And, in the current 16% of world population 116,300 million is being analyzed to receive the service by the company^{1,2} in figure 1.

Water can be used in ordinary homes and industrial sites, various facilities pollute the water directly and indirectly to various types of sewage. In 2012, according to

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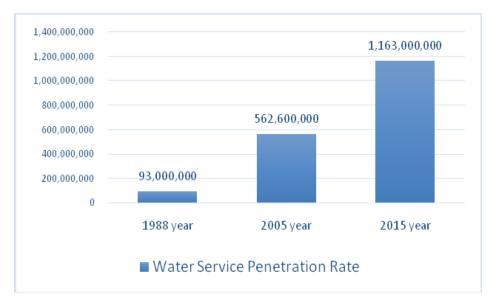


Figure 1. Water Service Penetration Rate.

an announcement from the Ministry of Environment 'Groundwater quality measurement operating results report, the results were 6.5% of judges surveyed 322 sample water unsuitable for a national sample of 4,952. The water pollution caused by the partial sources that are not only ground water. Purifier in a multi-use facility is also where you find general bacteria test results judged unsuitable. Thus, when using the water of the contaminated water or below the reference value in the form of drinks, or other foods, the water is the pathogen produces contaminants³. These, contaminants through the mouth or skin and invade the body and cause diseases of the digestive system occurs. Thus, increasing distrust of the people and drinking water and drinking water as a result of the investigation is available for the 1.4%. After all, it is necessary to develop a system in which ordinary people can drink the water without a doubt^{4,5}.

In addition, cyanide, mercury, organ phosphorus, toxic substances, such as cadmium, copper, there may be acute, chronic poisoning caused by toxic substances such as lead. This will occur from the consumption of fish and shellfish caught in the water source used for drinking or also directly contaminated water or contaminated with hazardous substances, or bodies of water. As such, a grow-

ing interest in the quality of drinking water safety for the user in accordance with the change of the zoom growth and environmental factors in the market. Therefore, the government has enforced the huge budget each year on drinking water quality management. After all, there is a need to prevent such damage from occurring from the hazards^{6,7}. To this end, it is necessary to measure in real time the objective and reliable information in a more close and environmental conditions. Finally, a new service that allows users to self-determine the safety of the water is absolutely necessary.

Therefore, in this paper, we implemented a system integration module for measuring water quality in real-time to design, implement a module integrating the four sensors. Through this system, that the water quality in a way easy to check in real time the measurement result information is a technique that provides rapid water quality information that a user can trust. To this end, we designed a module integrating the pH sensor, Conductivity sensor, ORP sensor, Temperature sensor in one. Additionally, the Bluetooth module was mounted to produce a smartphone and a water measuring devices that can be connected via Bluetooth communication between the measuring devices. Finally, by processing the trans-

ferred data measured by the measuring instrument it was provided to the user. Also, the output was measured by a water quality of water to show the measurement data to a user based on the water quality standards.

2. Design of multifunction integration module

In this paper, we use the four sensors to design a multifunction module. Integrated module was used for the pH sensor, conductivity sensor, ORP sensor, temperature sensor. Through this, the water quality can be measured automatically for the 24 different items as shows in table 1.

The basic structure of the measuring instrument was constituted by the sensor and the main board. The motherboard to a general data transmission and performs a function that a smart phone. Also, the sensor unit consists of a pH sensor, Conductivity sensor, ORP sensor, Temperature sensor in figure 2.

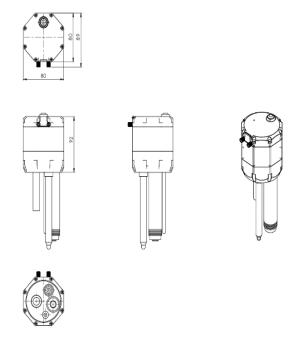


Figure 2. The curve under the condition of (A).

 Table 1.
 Integration Module Metrics

Sensor	Item	Contents
рН	Directly related topics	Cleaning agent, Chlorine ion, Sulfate ion, Ammonia nitrogen, Dichloro acetonitrile, Formaldehyde
	Indirect related topics	Boron, Arsenic, Selenium, Mercury, Cyanogen, Cadmium, Total trihalomethane, Chloroform, Bromodichloromethane, Dibromo dichloromethane, Potassium permanganate consumption, Zinc, Manganese, Copper
Electrical conductivity	Directly related topics	Hardness
	Indirect related topics	Selenium
Dissolved oxygen	Indirect related topics	Nitric nitrogen, Turbidity

Embedded sensor data transmission system is linked to the measurement of integration modules and smart devices, it applied at a distance of less than 10m a Bluetooth synchronous connection-oriented links manner. Through this, it was confirmed whether or not the operation of the sensor on the smart device and designed in such a way to transfer the measurement data of the sensor wirelessly. In addition, the complex was designed to send the information about the sensor-specific metrics in the packet sent to the smart device^{8,9}. By simplifying the processing of the data and to minimize the power consumption of the aircraft is designed as a sensor integration module.

Smart device program is designed in a manner that displays the display information of the sensor data. Smart device program information of the measured receiving quality by using a data communication according to a defined policy values are converted to water quality, such as by passing evaluation chart to the user as an XML-based GUI in figure 3.

Step 1: Analysis of the leading technology of the smart device application development: Infrastructure design and development tools for application properties Step 2: Information about the sensor data and Policy settings for statistics: Numerical algorithm-star rating set of data measure

Step 3: Measurement of the sensor and hardware fault check and Bluetooth recognition by OS: Design features Bluetooth data transfer and OS version-specific compatibility tests

Step 4: Sensor utilizing a Bluetooth synchronous connection configuration function: Mobile-based sensor control technology

Step 5: Algorithms designed to simplify the interface with the charting of data: Design sensor data dashboard and GUI development

Integrated process modules designed in this paper is as follows. So that users can conveniently view the data passing through the measuring device constitutes a GUI using a gauge chart. So that users can conveniently use the GUI to configure a user-centered. Implement a multifunction water quality measuring device that incorporates

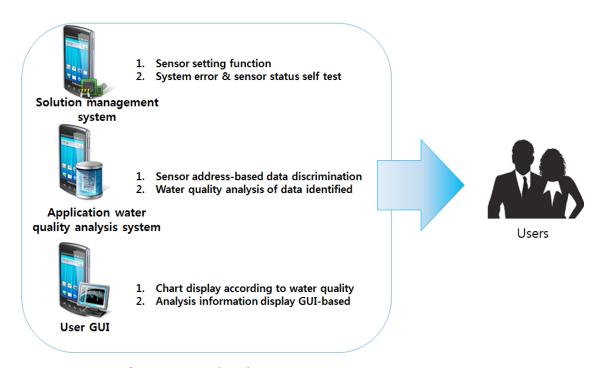


Figure 3. Design of Smart Device Algorithms.

a total of four sensors including a water quality sensor 3 and one temperature sensor. It performs a connection via Bluetooth communication between smart devices and water meters. Connect the water meter and smart devices using Bluetooth communications on the application. It is implemented to enable the data transmitted using the Bluetooth communication comprehensive data of the measurement result value in the smart device. By processing the measured data transmitted through the water meter it is provided to the user. It illustrates the measurement data to the user and outputs the measured water quality of water based on the water quality standards¹⁰⁻¹².

3. Implementation of Integration Module

In this paper, we implemented a multi-sensor integration module for automatic water quality measurement. Integrated multi-function module is a system that integrates the features and functionality of smart water analysis sensor device. Easily implemented in the existing system and water quality was developed to take advantage of a variety of information about the water quality analysis. Multifunction automatic water quality measurement module is an integrated system that combines smart water analysis equipment and sensor integration module.

The measured value of the water quality data measured by the water quality measuring device was connected to the Bluetooth communication. In addition, the receive transfer measurement data from smart devices and implemented the application. It was equipped with a Bluetooth 4.0 module showing a low-power high-efficiency and it developed a water quality measuring device that can be connected to a smart device and data transfer. If the water quality measuring instrument, it cannot ignore the fluctuations in the measured values due to noise of the measuring device itself. Therefore, data were summarized and analyzed using a DB designing a stabilization algorithm for water quality measurement data. In addition, I guess the DB of the quality metrics data received through Bluetooth communication unit from the water measuring devices. Implemented a data analysis algorithm to output the measured value to the user. Finally, using the main function water quality measuring device integrated module was developed to measure the level of water. Through this, we implement the additional services that the user provides useful information about the water quality measurement results in figure 4.

Water quality management system is a database that stores water quality data space is required. Value systems, policies, user preferences information for water quality measurement, sensor ID, sensor information,

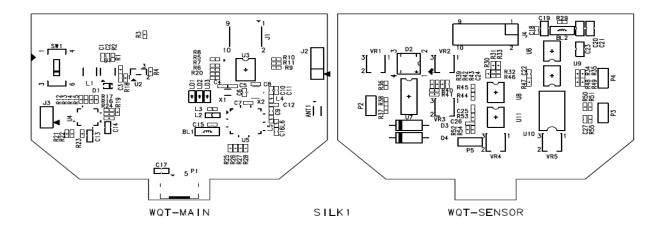


Figure 4. Main Module(Left) and Sensor Module(Right).

and application logs, any user is stored measurement data management. In addition, the sensor detects a malfunction, the problem misrecognized by the Bluetooth communication and serves to assist the accuracy of the measurements. Integrated water quality measurement module using the power button on the top of the instrument to be implemented on the power to on / off. And, it is applied to power the measuring instrument was implemented to connect the power applied to the water quality measuring a USB cable. Also, by mounting the Bluetooth module to the main board it was to synthesize the measured data from the sensor section to transfer data. Finally, whether the sensor unit are connected with the main board of the water meter was implemented to determine itself by using the smart device.

Water quality measurement program was composed of user-friendly for the user's convenience improves GUI. The development environment is developed and implemented for the PC version of the Windows 7 operating system. Smart devices for testing was applied on the Android 5.0 experience.In addition, we implemented a complex connection between the water meter and smart devices using Bluetooth communication. The measurement data using a composite water meter was carried

out the function of transmitting data using a Bluetooth communication. The compound water meter developed a water quality determination function through the analysis of the measured data. Finally, it was developed to provide additional services and useful information to the user quality in figure 5.

Ensure water quality data by converting the voltage value of the data values transmitted to the smart meter devices through re-converted to hexadecimal and hexadecimal by the transfer voltage value. Because it implements the instrument by utilizing the electronic board there may be a variation in the value due to noise through the electronic substrate. Therefore, one way to store the data that is sent once per second to fix it to the DB storing the measured values and then, returns to stabilize the average value variation due to noise. Based on each measurement of the sample solution in accordance with the data converted into the voltage value in the temperature and creating a standard reference table. Obtaining the slope formula based on the written standard reference table after processing a data unit according to each of the metric provides the measured value to the user in figure 6.

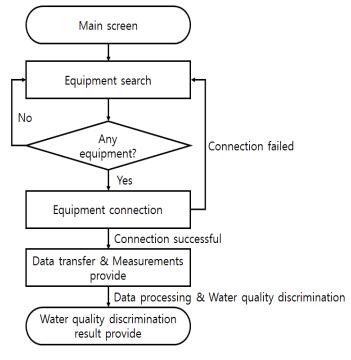


Figure 5. Water Quality Measurement SW Algorithm.

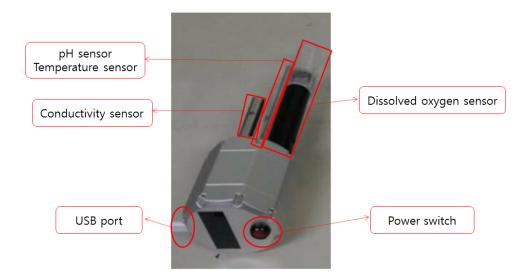


Figure 6. Implementation of Water Quality Measurement Device.

4. Conclusion

A sharp increase in the water market and water industry development policies and increasing the number of water-related businesses. Water only in the year 1999, worldwide more than 70 related companies was more than doubled 164 in the year 2010. In particular, the developing countries has also significantly increased the number of water-related businesses.

Therefore, in this paper, we implemented a system integration module for measuring water quality in real-time to design, implement a module integrating the four sensors. Through this system, the water quality can be checked easily in real time measurement. To this end, we designed a module integrating the pH sensor, Conductivity sensor, ORP sensor and Temperature sensor in one. Additionally, the Bluetooth module was mounted to produce a smartphone and a water measuring devices that can be connected via Bluetooth communication between the measuring devices. Finally, by processing the transferred data measured by the measuring instrument it was provided to the user. Also, the output was measured by a water quality of water to show the measurement data to a user based on the water quality standards.

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