Water Refilling Station Monitoring System using TDS meter with SMS

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Abstract—To evaluate the quality of product water, most owners of Water Refilling Stations (WRS) conduct their own checking and monitoring of product water manually through the use of Total Dissolved Solids (TDS). However, the method is time consuming. Hence, this study aimed to develop a device that can monitor the water quality of water refilling stations. It also aimed to automate the manual operation of monitoring the product water. The study utilized the developmental and descriptive method. The device comprises of a microcontroller and uses various sensors to measure the quality of the product water in terms of total dissolves solids (TDS), electric conductivity, temperature and the turbidity. A system logger, records all the values from all the sensors and displayed them on the LCD. An SMS notification was also sent to warn the predetermined recipient if the TDS was high or low. The device was evaluated by twenty respondents. They were chosen using purposive sampling. The findings of the study revealed that the efficiency and accuracy of the device and system was excellent. It was also found that the proposed method of monitoring the product water is highly acceptable.

Keywords: Product Water, Total dissolves Solid, SMS notification, water refilling station

I. Introduction

One of the fast expanding business in the Philippines is the water refilling station. It is located on every street corner because lot of people in urban areas prefer to get drinking water from refilling water stations. In Talisay City, one of the cities of the Province of Negros Occidental, Water Refilling Stations (WRS) managed by private entrepreneurs offer a cheaper and more convenient solution to the public's drinking water need. The city health officer was represented by the Secretary of health to issue the Certificate of Potability of Drinking Water. Monitoring must be done on water refilling stations at least monthly. The results of the water analyses done by the City Health Office are part of its regular evaluation and monitoring with the slow process of receiving the results. To evaluate the quality of product water, most owners of WRS in Talisay City conduct their own checking and monitoring manually using the Total Dissolved Solids meter. However, this method was time consuming and not efficient. Since it was not possible to take the water samples every hour and measure its qualities.

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This study, Water Refilling Station Monitoring System using TDS meter with SMS provides real-time monitoring of water quality. The device uses four sensors in monitoring the quality of water in terms of Total Dissolved Solids, Turbidity, Electrical Conductivity and Temperature. The measured values are then sent to the system logger and eventually an SMS notification is sent to the owner.

II. Objectives

1. To design and develop a Monitoring System for Total Dissolved Solids (TDS), Turbidity, Conductivity and Temperature of product water of Talisay-based Water Refilling Stations;
2. To assess the accuracy and effectiveness of the device and the system in monitoring the quality of water;
3. Generate reports needed by the refilling stations in monitoring the quality of the product water; and
4. Determine the acceptability of the proposed method of monitoring the product water.

III. MATERIALS AND METHOD

The development of the Water Refilling Station Monitoring System with SMS consist of ATMEGA 320 microcontroller embedded in the Arduino board and SMS module and four sensors to determine the quality of product water: in terms of TDS, turbidity, conductivity and temperature. It is important to monitor the TDS because it can affect the health of the consumers. The lower the TDS level in the water, the more efficiently the body's cells actually get hydrated by the water. The higher the TDS level in the water, the greater the probability of harmful containments that can pose health risks. According to the World Health Organization (WHO), Total dissolved solid (TDS) refers to the total weight of all solids (minerals, salts, or metals) that are dissolved in a given volume of water, Expressed in milligrams per liter (mg/L), or in parts per million (ppm). The standard value of TDS is <10ppm for product water that has undergone reverse osmosis or distillation process. Another parameter to be monitored is the turbidity since it measures the clarity of water. According to WHO an increasing risk of gastrointestinal infections correlates with high turbidity and turbidity events in distribution. This may be because turbidity is acting as an indicator of possible sources of microbial contamination. The standard measurement or value of turbidity is lower than 5 NTU (WHO). The next is electrical conductivity (EC) it actually measures the ionic process of a solution that enables it to transmit current. According to WHO standards, EC value should not exceeded

400 μS/cm . High water temperature enhances the growth of microorganisms and may increase problems related to taste, odour, colour and corrosion. Wherever possible, water temperatures should be kept outside the range of 25–50 °C and preferably 20–50 °C to prevent the growth of the organism (WHO).

The evaluators of the device were chosen using the purposive sampling technique. Twenty individuals comprising of the Water Refilling Station Owners, Water Refilling Manufacturer (Technicians) and Talisay City Health Office Staff were asked to rate the device. In the absence of a standardized instrument for data gathering, a researcher-made questionnaire was utilized. The said questionnaire passed the validity and reliability tests. The Likert 5-point scale was used to interpret the responses of the respondents. The analysis of the results were based on the responses of the participants to the various items of the questionnaire. The results were evaluated, calculated and statistically treated. The means were computed from each criterion to determine the overall performance of the device. The results of the survey were analyzed and were considered in the process of making the system. The System Logger will records and generate reports of the value of the TDS, Turbidity, Temperature and conductivity. An SMS notification to the owner and technician if the TDS value is HIGH.

IV. System Architecture

The prototype monitors the product water in a Water Refilling Station. From the source water (deep wheel, water pipe line) the water has undergone reverse osmosis and processed is now called the product water. The product water tank A will flow to the first solenoid valve A, the solenoid valve is the switch of the microcontroller, comprises with the different sensors. The microcontroller box was attached in the two solenoid valve B and C. If the TDS is low/ normal the solenoid valve C will open and it will flow to the faucet of the refilling stations. While if the product water will have a high TDS value the reverse osmosis machine will stop and automatically the valve B will open and valve C will close, the solenoid valve B will flow to the product water tank B, the water from the product tank B will flow back to the reverse osmosis machine until such time the TDS value is low. The SMS module from the microcontroller box will send a notification to the owner / authorized personnel the value of the TDS and the system logger is a real time in recording the value of the TDS, temperature, conductivity, turbidity and the time that send the SMS is sent.

V. Device And System Testing

The microcontroller component data from different measuring tools and sensors data were well configured. These data were then displayed on the LCD panel and system logger. The SMS notification was sent to the authorized person. A series of individual module testing of the different components had been done to get the requirements needed by the microcontroller and the system logger. The test was carefully analyzed before the pilot testing of the prototype. The researcher demonstrated the device or the prototype together with the conduct of the survey questionnaire to the respondents.

The results were evaluated, calculated and statistically treated. The means were computed from each criterion to determine the overall performance of the device. The results of the survey were analyzed and were considered in the process of making the system. .

VI. Result and analysis

To identify the accuracy and effectives of the device and the system in monitoring the quality of water. The score of 4.95 as a result of the Water Refilling Station Monitoring System using TDS meter with SMS evaluation on the items in the prototype is interpreted as Excellent. The means of all the parameters are lower than the standard of the World Health Organization from the Guidelines for Drinking-water Quality with average of the following: turbidity is .74 NTU, the Total Dissolve Solid is 1.04ppm, the Electrical conductivity is 125.52 μS/cm and temperature is 28.2 °C. The acceptability of the proposed method of monitoring of product water. The score of 4.96 as a result of the respondent evaluation on the items about the acceptability of the proposed method is interpreted as very highly acceptable.

VII. Conclusion

Based on the findings of the study, the following conclusion are formulated 1. The device is a big help to the Water refilling station especially in management in monitoring the quality of the water in Water refilling station in Talisay City. 2. The functionality of the device improved the process of monitoring water quality. 3. In the actual testing of the device the respondents were satisfied with the concept of the Water Refilling Station Monitoring System using TDS meter with SMS for Talisay-based Water Refilling Stations

VIII. Recommendation

In the light of the findings and conclusion of the study, the following recommendations are forwarded: 1. Additional tools in monitoring the quality of the product water such as PH meter

2. Additional tools should be installed in the device to measure the chorine residual before it will be filtered. 3. Additional features such as alarm system to the microcontroller when the TDS is high

4. Additional feature to be recommended are android base application to monitor the different value of the quality of product water. 5. Cheaper Sensors must be considered in the future study.

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