SMART RO USING INTERNET OF THINGS.

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ABSTRACT

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.

I.INTRODUCTION

The next progress in the era of development will be the automatic working of the things. The things surrounding us will be connected with each other with the help of network which automation. The use of these devices would involve three main steps: capture of data using sensors, collection of data over the network and decision making based on analysis of data. Each sensor provides valuable data which tell about the working of things. The indispensable part of IoT is smart connectivity of the things with the network.

Although the definition of Things has changed as technology evolved, the goal of making computer to sense the information without the aid of human intervention remains the same. IoT is a concept to interconnect the uniquely identifiable embedded computing devices as expected to offer Human-To-Machine (H2M) communication by replacing the model of Machine-To-Machine communication which exists nowadays.

The convergence of multiple technologies had done from embedded systems to micro-electromechanical systems, and also from the wireless communication to internet. It has brought an upsurge in the development IoT technologies.

IoT provides a platform for the objects to manage and organize themselves which makes them recognizable. In the future there are many application of IoT such as smart city, smart home appliances etc. Each thing is uniquely identifiable but follows a common infrastructure.

It is the common IoT platform that collects diversified information together and provides common language for devices and apps to communicate. The process starts with the devices themselves which securely communicate with an IoT platform. These platforms integrate data from many devices and share the same to the industries specific need.

In this paper the communication is established between mobile application and the RO System. Thus the RO System is controlled by giving instruction from mobile application. The proposed system also displays the pH of purified water as a message on mobile.

The pH of water plays an important role. The acidic or basic water have adverse effects on the human health. If the neutrality of water is not as per requirement, it may lead to chronic diseases. The pH of healthy water should be between, 6.5-8.5. Generally the purified water from RO system is more pure than healthy. If the input to the RO system is basic water, the purified water is slightly acidic. Thus the ph of purified water is not in recommended range. So an additional circuitry is deployed that improves the pH content of RO purified water. The external module consists of water ionization filter. The ionization filter is a device which alters the pH of water when compared to threshold value. The system consists of the pH determining circuit along with the water ionization filter. Also the quantity of water to be filtered is given according to users' choice at any time. Thus there is no need to wait for the filtration of water. In this way the RO System is made automatic.

II. RELATED WORK

From the ancient time many practices are done to improve the quality of water. A number of people had given their contribution in this field. Many organizations had also launched their product which purifies the water and removes all the undesirable contents from it as the impurity. So according to our demand the RO System can be selected. Barbara Kneen et all in the paper [1] Reverse Osmosis treatment of Drinking Water- describe about the contaminants present in the water and due to various dissolved solvents such as pesticides, hydrogen sulphide and many more and also due to various harmful gases present. They made a brief study on the topic and concluded that Reverse Osmosis cannot remove some of the harmful contaminants. S M Khaled Reza et all in paper [2] Microcontroller Based Automated Water Level Sensing and Controlling: Design and Implementation Issue describe about the reduction in electric consumption and water overflow due to Water Level management. Further they have describe that the Global Water types including cellular data loggers, satellite data transmission systems for remote water monitoring system can be supported by amount of water in tank. Also they concluded that the cellular phones must be reuse because they have a relative high computation power and high quality graphical user interface. Dr Egon Hufner in Flexible Measuring and Control in the paper [3] Reverse Osmosis Systems discussed the general requirements in industrial reverse osmosis systems. The state of the membranes should be checked while measuring the conductivity of the water. This is the percentage retention value and an indication of a defective membrane. O J Morin in the paper [4] Principles and Practices of Reverse Osmosis explained the different type of filtration used in the RO Process. A reference RO Model is also given. The different process used in the RO Process with the pre and post treatment used, are also explained. The different solvents are used in the purification of water.
It is concluded from the related work that the progress had been done to improve the filtration of water. But so far the pH content of water is not dealt with. The proposed system emphasis on improving the pH content of water.

III. SYSTEM ANALYSIS

Definition of Problem

The conventional Reverse Osmosis System face certain challenges as poor manageability, excess use of water and electricity. Also the purified water can't be trusted for pH value. Any slight change in the pH value may affect human body mechanism. The main objective of the proposed system is to design an automatic RO using IoT . The system measures the pH of water. The water needed for consumption is only filtered by it and given as the command by the user.

Features of Proposed System

The proposed system consists of Atmega 328 controller, wi-fi module, conductivity sensor along with water ionization filter. Atmega 328 controller can be easily configured to handle more hardware interface module (sensors). The proposed system can be accessed from any Android mobile application through identified IP. The Internet of Things along with the wi-fi technology is used to provide the automation to the systems and improve its' quality. The proposed model is implemented with the additional circuit consisting of water ionization filter. The ionization filter comes into picture when the pH of purified water is not as per the threshold set. The pH value of water cannot be find easily. The pH sensor is not readily available as it is not manufactured yet. As the pH value is the concentration of hydrogen ions in water. The pH of acidic water is in the range of 0-6. The neutral water has a pH of 7 and basic water has pH of 8-14. The conductivity increases due to increase in alkalinity. The pH value and conductivity are interrelated to each other. If the conductivity is more the water is alkaline and the pH can be predicted. Therefore the user gets the idea of pH. The proposed system is also compatible with the existing RO system. Hence the system can be employed into existing RO system to convert them to smart RO system.

IV.SYSTEM DESIGN AND IMPLEMENTATION

A. Proposed Smart RO System

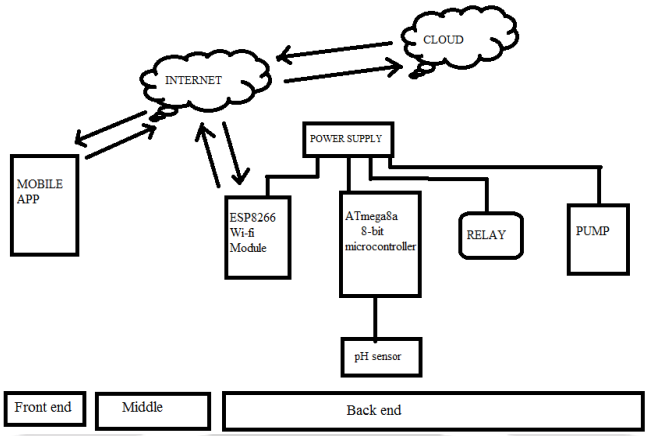

Fig 1: Proposed Smart RO System

The proposed Smart RO System is divided in 3 parts-front end, middle end and back end. The front end is the mobile application, in middle cloud is working as communication interface between mobile app and backend and the hardware model is at back end. The model consists of controller, conductivity sensor, Wi-fi module, submersible pump and relay, power supply unit and mobile app to control. The back end is implemented in the RO System. The sender sends command through android app about the amount of water need to be filtered. The command gets stored in the cloud. To communicate with the cloud the wi-fi module, ESP8266 is used. The instruction is processed by Atmega controller. The controller turns on the relay. The relay then triggers the submersible pump. The conductivity sensor is used as the input to the microcontroller. The program gives the pH value of filtered water on LCD. The same pH value is stored in the cloud which could be again seen by sender on mobile application. In the cloud the pH is compared with the threshold value. If it is below threshold, water is automatically directed towards ionization filter. The water ionization filter is an external circuit provided to improve the pH value.

After processing through ionization filter, the water obtained is now with recommended pH. The pH of output water from ionization filter is again displayed on the front end application for comparison. The user is thus entrusted with the quality of water. Thus, the proposed system leads to efficient use of electricity and also prevents excessive use of water.

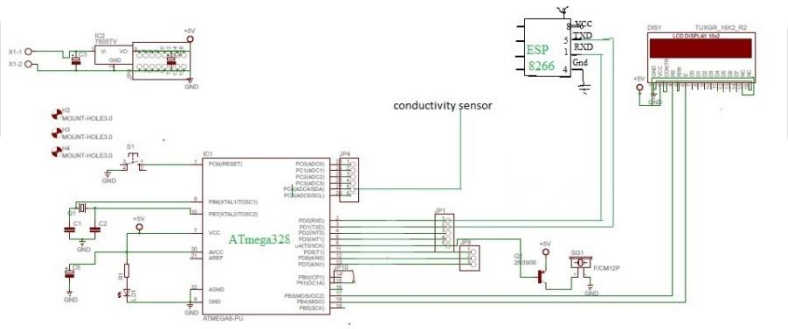

Fig 2: Circuit diagram of Proposed System

The circuit explains the simulation process of proposed system. The time required for the simulation depends upon the quantity of water filtered by the RO System. The quantity of water to be filtered is given as the input from the front end application. The app has options as 1 liter, 2 liter, 3 liter etc as the buttons. The button is clicked according to the requirement and then this signal is received by the wi-fi module through internet. This wi-fi module transfers the input to the microcontroller. The microcontroller has a counter of 5 sec duration.

Therefore when 1 liter is given as input the system work for 5 sec. Similarly when input of 2 liter is given, the machine becomes ON for 10 sec and so on. Thus the quantity of water to be filtered is controlled by the user. The conductivity sensor is used to find the pH value of water. Therefore it is connected to microcontroller as the input device. The variation of the conductivity with time is also stored on cloud. The graph showing the variation of conductivity with
time is as:-

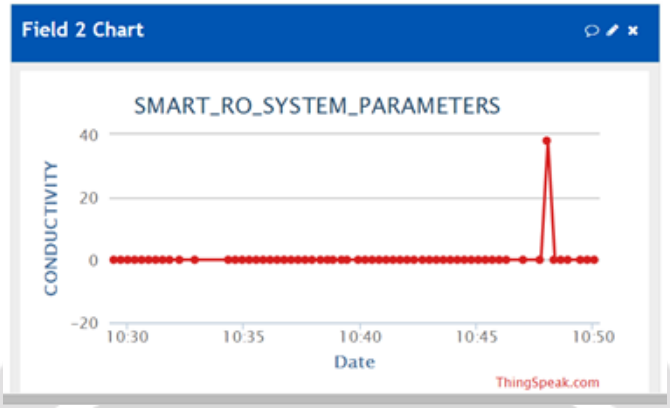

Chart 1: Graph showing variation of conductivity of water

The work done by the cloud can also be recorded. The data is recorded with respect to time. Therefore the conductivity as measured on the date is shown as the peak in the graph. The conductivity is measured only for certain time, so the graph comes down sharply after few seconds.

Proposed Smart RO System functions

The proposed smart RO system has following capabilities:

- It can be easily accessible throughout the globe.
- It only filters the said quantity of water.
- It also lets us know the pH of filtered water.
- If pH value of water is not as per requirement, the system alters the value making water healthy for drinking purpose.

Software Design

Mobile based application:

The frond end application is the mobile application which is basically used to give the command to the user. This application is developed with software called MIT App Inventor. It is an open source web application provided by the Google. It is nowadays maintained by the Massachusetts Institute of Technology. This software uses the mechanism of graphical interface which allows the new comer users to develop the android application by dragging and dropping the objects. It is a cloud based tool means we can develop the apps on the web browser.

Fig 3: Screenshot of mobile application

Cloud Storage

Thing Speak is an open sources platform to allow devices to interact with apps, things and web services. Thing Speak is open to any type of data from application and devices.

The Internet of Things provides the access to a broad range of web by collecting, storing, analyzing, visualizing, and acting on data from actuators or sensors, such as Arduino, Raspberry Pi and other hardware. For example, with Thing Speak things are created such as location-tracking applications, sensor-logging applications, and a social network of things with status updates, so that the home thermostat can control itself based on the user's current location.

The primary element of Thing Speak activity is the channel, which contains data fields, location fields, and a status field. After the Thing Speak channel is created, the data can be written to the channel, process and view it with MATLAB code, and also react to the data with tweets and other alerts. The typical workflow of Thing Speak:

1. Create a Channel and collect data
2. Analyze and Visualize the data
3. Act on the data using any of several Apps

Open API, Real-time data processing , Multiple Data Types , Location and time , Charts , Apps, Plugging are some of the features of thingspeak.

V.CONCLUSION AND FUTURE WORK

A.Conclusion

The Smart RO System using Internet of Things has proven to be remotely controlled through the internet. The design system not only measures the pH value but also control the amount of water need to be filtered. The wastage of water is solved to a large extent. The pH value is also stored on the cloud simultaneously. So there is an advantage to access the system throughout the globe.

B. Future Work

Due to rapid change in environmental conditions, human life is moving towards the world of automation. The smart RO system can be expanded to include the smartness of understanding the gestures and facial expressions of individual. This will decrease the need to give command to the RO system and also increases its reliability.

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