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International Journal of Current Research
Vol. 9, Issue, 10, pp.60136-60139, October, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

SMART WATER MANAGEMENT SYSTEM USING CLOUD COMPUTING AND IoT

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ARTICLE INFO

Article History:
Received 26th July, 2017
Received in revised form
15th August, 2017
Accepted 18th September, 2017
Published online 31st October, 2017

Key words:
Water management system,
Ultrasonic sound, Ultrasonic sensor,
Arduino, solenoid valves,
Distance formula.

ABSTRACT

From our daily life, we see quantities of water getting wasted. Hence we are proposing a project where the water can be used in a smart way. This system can be easily installed in various surroundings. Sensors placed in the tank which continuously informs the water level at the same time interval. This information will be updated on the cloud; user can visualize the water level on computer system that is connected to Internet. According to the level of water in the tank the valve functioning will be automatically controlled, at low level of water valve will automatically turn on and when tank is about to fill up it will cut off [2].

Citation: Sureshkumar Natarajan, Shashank Roy, Arjun Singh and Aniket Bhosale, 2017. "Smart water management system using cloud computing and IoT", *International Journal of Current Research*, 9, (10), 60136-60139.

INTRODUCTION

The important thing is to manage the water resources for the future use. We are planning to design a system that is very efficient. We will collect drinkable water from sources and store that in tank, from there we will distribute the water to various places. We are using Arduino MEGA as a main controller where we get all the parameters like level of water in all the tanks and filters. We analyze that data and processes that data. The controller will do the analysis based on the information obtained from the sensor and it will take a decision of controlling the solenoid valves. We will also get the analytical information on one protected system using cloud.

Smart Water Management

Consumers in the water sector provide a critical mass to influence in decisions resulting in appropriate changes. The water sector operates in a complex interaction between water resources and the socio-economic system. The range of stakeholders is huge, public and private, from global to local companies, and supported by nation. This different nature in associate and also the various schemes for water management, which are continuously evolving in every country, are the main reasons for current market scenario in water management solutions.

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An excessive market fragmentation is a problem for innovation under the desirable paradigm of an Integrated Water Resources Management (IWRM), by slowing down the adoption of open reference architectures and standards (Tomas Robles *et al.*). This approach could enable interoperability, making it easier for developers to upgrade current solutions and integrate and adopt innovative ones.

Water Management model

The efficient way of utilizing any resources is to introduce those resources into existing technology to make the proper usage and maintenance of the resources (Kumura Takahiro *et al.*). There is vast usage of water resources in the community where we are leaving. To make this in realistic way we have come into a smart water management model. This is totally managed by the sensors and the controllers without any human interference. We have explained the model in detail below:

Main Tank: This is the main storage tank where.

We collect the drinkable water from the resources. There is an Ultrasonic sensor which provides the all the details of water level in the tank. All this data is fed to the controlling unit for further manipulation. The inlet of this tank is from a solenoid valve which can be controlled by program.

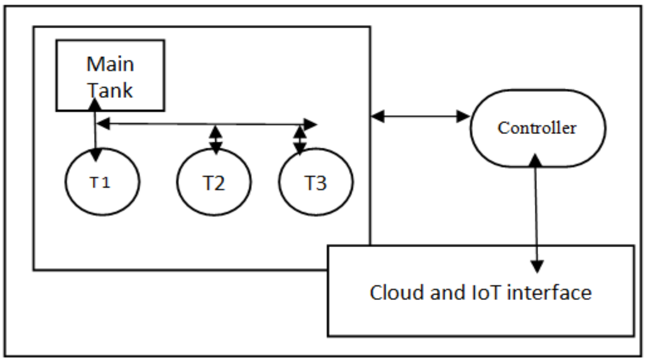


Fig.1.Water Management Model

T1, T2, and T3: T1, T2 and T3 are the Sub-Tank of the main tank. From here consumer can outlet the water for their usage**.** Here also the level of water is maintained by the Ultrasonic sensor and the flow or refill of these is done by Solenoid valve. This is the actual output section of the Model.

Controlling Unit: This is the main block of the model. From here all the Solenoid valve is controlled by program incorporated in the controller here we have used RASPBERRY PI 2 as the controlling unit (Pritish Sachdeva and Shrutika Katchii, 2014). The value of water level and the Warning signals is generated from here.

Cloud: In this section all the manipulated data is generated in the form of graphical way. We have used Twilio client. We also get the warning signals from this client. We consider this part of model as the information extractor of the model.

Warning System: It comprises of mobile phone or the desktop for the warning messages and action to be taken for the proper utilization of the model. In the program we have fed the mobile number where we get the messages and warnings related to data.

IoT for Water Management

The provision for Internet of Things capabilities in Water management scenarios can be achieved if we consider some considerations from the business, social and technical aspects. Following are the main benefits of providing IoT in water management scenarios:

Efficiency increase

Water management companies can use real-time operational control to make smarter business decisions and reduce operating costs. They use real-time data from sensors and actuators to monitor and improve water management infrastructures, making them more efficient and reducing energy costs.

Economical: Water management costs can be reduced through improved proper utilization, process and productivity. Customers and organizations can benefit from improved utilization (e.g., smart water irrigation units that eliminate manual operation) and service improvements.

Asset utilization: With improved tracking of assets (machinery, equipment, tools, etc.) using sensors and connectivity, companies can benefit from visibility into their assets and supply chains. They can easily locate assets and run preventive maintenance on critical pieces of infrastructure and machinery.

Productivity increase: Productivity is a most important parameter that affects any organization. IoT allows real-time control, process optimization, service time reduction, and the capability to do all of this globally, reducing the mismatch of required versus available skills and improving labour efficiency.

Functional Environment of mode

The function of the model is divided into 3 parts:

Function 1: In this all the data from ultrasonic sensor is calculated and stored to cloud but before storing we convert that analogue data into distance (cm) format by using equation (1).

Round (ultrasonic.distance*100,2) (1)

Function 2: In this function by using the above function we decide the closing and opening of the Solenoid valve for refill of the tanks.

Function 3: This function we generate warning signal to the desired mobile phone number. We use Warning message as;
When tank is full - Tank is full n need to take any action.

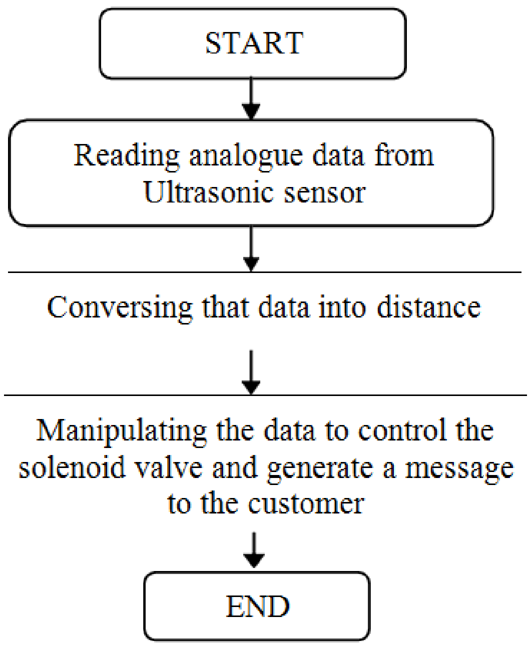
When tank is half - Level of water is decreased by 50%. Attention...!"

When tank is near to empty - Attention...!!! The water is about to empty. Take some Action.

When action took place - Action taken Solenoid Valve is open.

Algorithm

Step1: Read the analogue data of Ultrasonic sensor.
Step2: Manipulate that data into distance.
Step3: Apply the results to control the Solenoid valve.



EXPERIMENTAL RESULTS

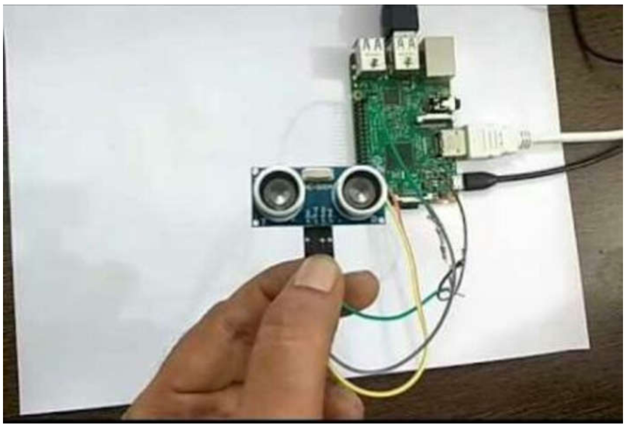


Fig.2. Interfacing Ultrasonic sensor with Raspberry Pi 2 for distance measurement

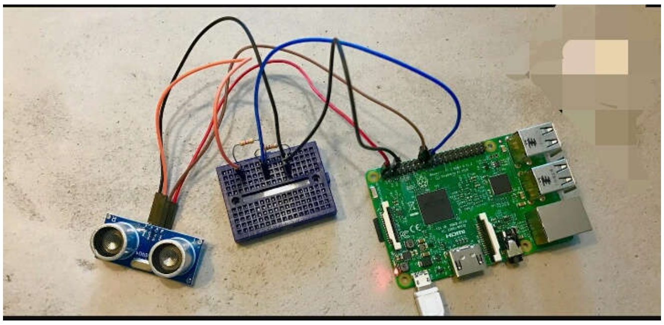


Fig.3. Wiring connections for the measurement circuit

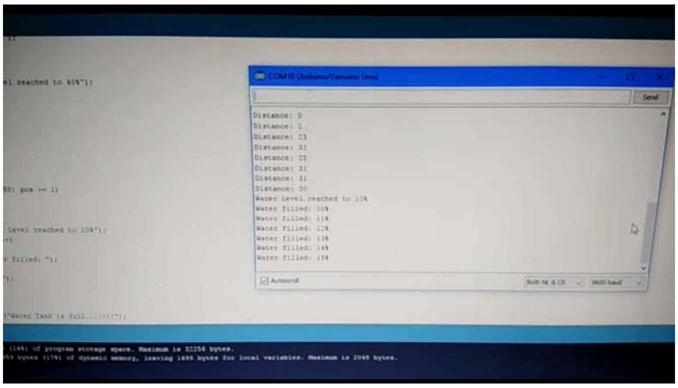


Fig.4. Message on command window for filling water in the tank at the initial refill with percentile

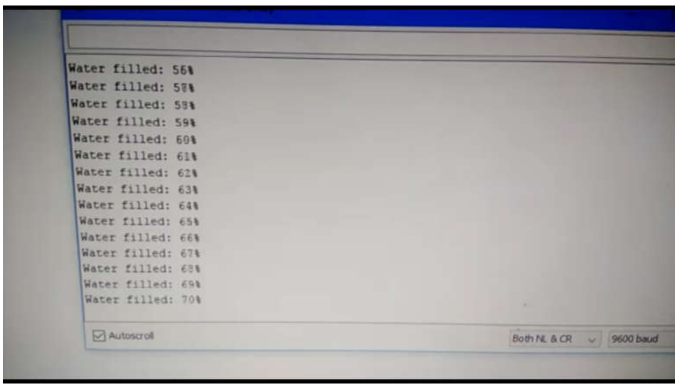


Fig.5. Message on command window for filling water in the tank at mid-level

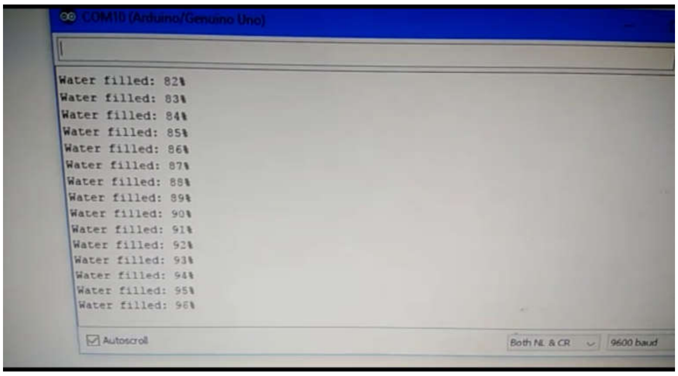


Fig.6. Message on command window for filling water in the tank to full level

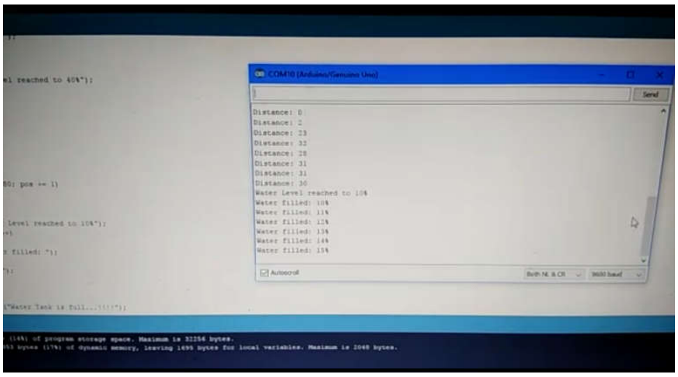


Fig.7. Message on command window when water level reached to 40%

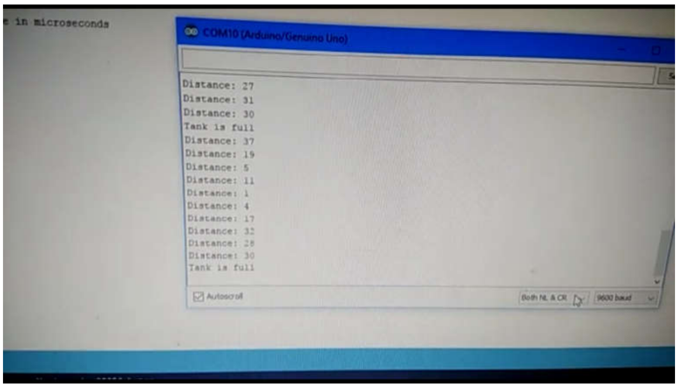


Fig.8. Message on command window when water in the tank is full

Fig.9. Raspberry Pi 2 firmware environments

We have taken the real life problem statement of schools, colleges, corporate sector and housing complexes where the management of water is not done properly. We have done few surveys on utilization of water and its application. So, we have come into result that to resolve this issue by developing a system that is enough capable of overcoming to all this issues to make the most utilization of water resources. We have got all the results and its operation defined in algorithm and allocate all the data to ThingSpeakCloud.

Conclusion

Defining a system like this will achieve its total usage and also will be very helpful to reduce the wastage of water. The implementation of this system is also very simple and well defined. And by experimenting this we have also got the desired result that we want. By concluding this project, we create a well-defined and sustainable system to reduce wastage of water.

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