International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 04 | Apr-2018 www.irjet.net p-ISSN: 2395-0072

Water Level Monitoring System in Water Dispensers using IoT

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Abstract -*One of the major problems faced by most of the large institutions is maintaining drinking water in water dispensers at various places inside the institution. Monitoring a large number of water dispensers in huge buildings require a considerable amount of manual supervision. This paper proposes a prototype system design, implementation and description of required tools and technologies to develop Internet of Things (IoT) based water level monitoring system which can be implemented in offices, colleges or buildings where many number of water dispensers are present. The smart water dispenser sends a notification when the level of water becomes low in the dispenser through an application to the authorized person. Once the person receives a notification for low water level, the application also provides him option to order water cans.*

1. INTRODUCTON

In day to day life there are a number of water dispensers for providing drinking water. Such as in collages, office and in many institutions. These dispensers are managed manually by a person, where a person checks each of the dispensers individually and accordingly manages it.

Many offices nowadays are superstructure buildings and occupy a large workforce. Same goes for colleges too. In order to fulfill the drinking water requirement a number of dispensers are placed throughout the building. Now, their management has become difficult. The purpose of technology is to make our life easier. So with the advantage of technologies like Internet of Things we can change the way we do things in a better way. The management of water dispensers becomes smart and easy using Internet of Things.

In this project main concentration is to manage the water dispensers by measuring the water levels. The system monitors the water dispensers by ultrasonic sensors placed over the dispensers and compare the level with threshold volume of the dispenser and then informs about the level of water left in the water dispenser via a mobile application to administrator [2]

The main goal of the proposed system is to monitor the water levels and manage overall dispensers. It will provide faster, easier and cost effective management. It also includes the design of monitoring system with advantages of low cost and accuracy.

2.LITERARTURE SURVEY

In[1],BezaNegashGetu, Hussain A. Attia proposed Automatic Water Level Sensor and Controller System. Here, an electronic system is designed to control and monitor the level of water in a tank or a similar reservoir based on the water detector sensor information. The electronic system is designed to automatically control and display water levels from zero to nine. The proposed system eliminates manual monitoring and controlling for home, agricultural or industrial uses. It uses water level sensor, seven segment display, priority encoder, relay and JK flip-flop.

In[2],ThinagaranPerumal, Md Nasir Sulaiman&Leong.C.Y proposed Internet of Things (IoT) Enabled Water Monitoring System. Here,the system is built on a microcontroller based platform Arduino Uno board which is interfaced with GSM modem and Ultrasonic sensor. The ultrasonic sensor is placed at the top of the can which helps in measuring the stature of the can. The IoT based water system is made using 2 different IoT sensors (i.e. ultrasonic, water sensor) by applying IEEE802.11 communication standards. The data transmission between those sensors is done by integrating a wireless gateway within the consumer network in them.

In[3],Nicola Ivan Giannoccaro, Luigi Spedicato proposed Ultrasonic Sensors for Measurements of Liquid Level, Volume and Volumetric Flow in a Tank. This paper presented a plan of an application of industrial interest. It helped in assessing the capacity of a tank, measuring and controlling the contained liquid level and flow by using ultrasonic sensors. A tank is generally represented by the lateral surface of a cylinder which can be generated by rotating a curve around a defined axis. This rotation of an ultrasonic sensor permits to fit out the generating curve of the surface so that the tank volume may beevaluated. This reconstruction then helps to measure the quantity of water contained in the tank by using a second ultrasonic sensor placed above the mouth of the tank .

3. DRAWBACKS OF EXISTING SYSTEM

1. Notification to the concerned authority: When the smart dispenser is empty definitely there should be a notification that has to be sent to the concerned authority. All the water management systems till now do this action by the way of sending SMS through GSM model. But there are chances that those SMS may not be definitely transferred to the concerned authority or might be prone

to spam messages by the hackers. This may lead to the wrong interpretation of the status of the cans by the concerned authority. If the SMS from the cans is sent all at a time it may also lead to traffic congestion and the entire system may be down for some time.

2. Use of Cameras for water line detection: The various smart dispensers developed till date use cameras in it. Testing with the installed cameras with a real-world image shows not so accurate detection of the water level with any different staff-gauge location. There also exists complex challenges of viewpoints variations, low quality images as well as changing illumination conditions.

3. Damage to sensors: Though smart dispensers can be built and established, it takes a lot of time to educate people about its use especially in the countries like India. Due to the lack of knowledge the people may not take care of the sensors in a proper way. There might be chances that the sensor be thrown away or might be damaged. In such cases there should be some proper mechanism through which the concerned authority should get to know about the improper functioning sensors and take necessary measures to replace or repair them.

4. PROPOSED SYSTEM

water dispenser management system proposed here involves building of the smart water dispensers. These dispensers are built with the help of ultrasonic sensors. When the level of the water left inside the dispenser reaches some calculated threshold value, then a notification is sent to the concerned authority through a mobile application. The mobile application then gets a push notification from the dispensers which are at a low level of water. Also, when the sensor is tampered or when it stops functioning, a notification is sent.

For the better implementation of locating dispensers, one single smart dispenser is built and for the remaining dispensers simulation technique will be used so that the entire system will be equivalent to building of two to three smart dispensers. Some networking concepts will also be used for the communication between simulators and application. Laptops will be utilized for the simulation purpose.

5. SYSTEM ARCHITECTURE

A model of the proposed smart water dispensers can be given by the system architecture shown below. This representation of the system presented gives a clear understanding of how the proposed system is being architectured.

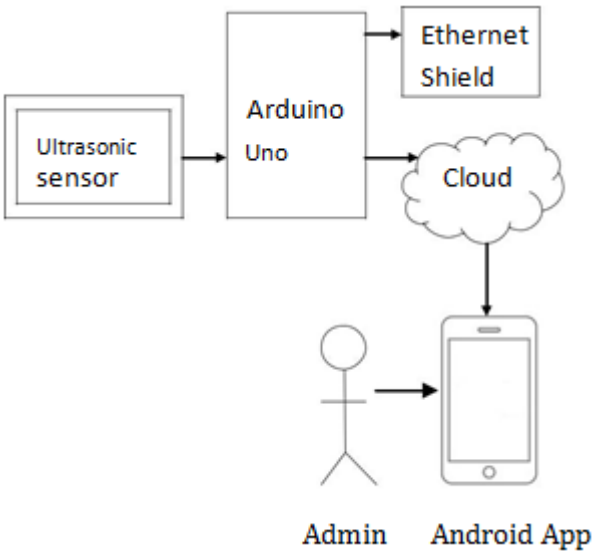

Fig-1: System Architecture

1.Firstly,the water level detection is done by the ultrasonic sensor.

2. When the water level reaches below a threshold value as specified by the user, the sensor notifies the Arduino Uno.

3.Then the data from Arduino is uploaded to the cloud storage.

4. The android app then receives a push notification on the authorized mobile.

5.1 ADVANTAGES AND DISADVANTAGES

Advantages:

1.In this system mobile application will be developed which is user friendly.

2.Only authorized people can have access to the application.

3.Sensors can be protected by notifying the authorized person in case of damage.

4.The proposed system employs smart water dispensers which use ultrasonic sensors to measure the level of water and Arduino.

5.Arduino on low water level detection sends a notification to an application using Firebase cloud messaging.

6.A mobile application will receive the message and notify the person in charge to take the necessary action.

7.Only a single person can manage multiple dispensers.

Disadvantages:

1.The proposed system is expensive and one system is used by one water dispenser.

2.The proposed system currently demonstrates only the admin module that can be logged in and be used to monitor the water dispenser. The users can also register, login and get some credentials as implementation of other modules.

6. DESIGN OF THE SYSTEM

The three main modules comprising the system are:

1.Admin module

2.Sensing the level module

3.Notification module

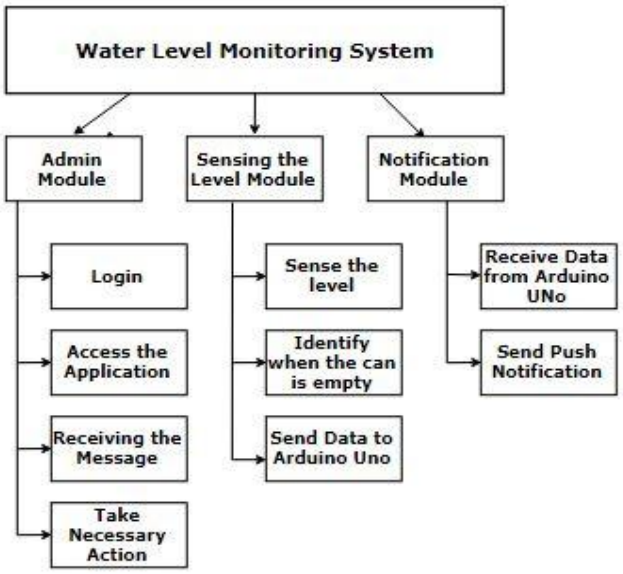

Fig-2: Design of the system

7. IMPLEMENATIONDETAILS

The working of the entire system can be represented by a flowchart. The system begins with the sensor connected to a water dispenser. The sensor checks the water level and sends signal to the Arduino Uno micro controller. Arduino Uno then forwards the data to the cloud. Using Firebase Cloud Messaging the information is sent as a push notification to the respective application.

The implementation details are:

1. A database is created that stores the water dispensers locations.
2. An android application receives notification for various causes.
3. An android device is registered with the mobile application to login to the application.
4. The data from the sensor is transferred to Arduino Uno when it detects low level of water.
5. The data from Arduino Uno is sent to the Firebase cloud.
6. The firebase cloud then notifies the android application running on the registered android device.
7. The user then uses the android application to place order for new can.
8. If no notification is received for many days the sensor might have been damaged.

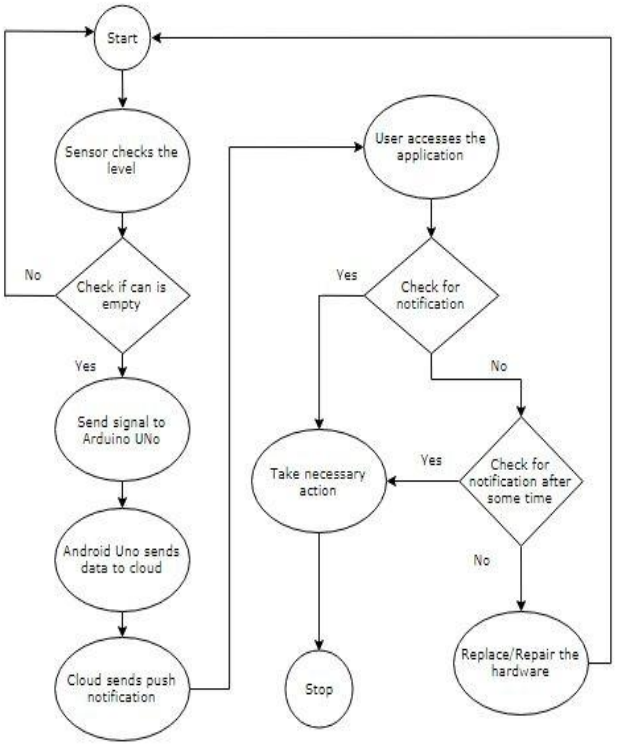

Fig-3: System flow chart

Algorithm:

The system implements the following algorithm:

Step 1: The hardware is powered on.

Step 2: The sensor measures the level of water. If the can is not empty repeat this step.

Step 3: The Arduino Uno micro controller sends notification to android application via firebase cloud messaging.

Step 4: The user after receiving the notification uses the application to order a new can.

Step 5: After the new can has been put into the dispenser the water level increases. Again start from step 2.

8. CONCLUSION

This study presented the design phase of Water Level Monitoring System in Water Dispensers using Arduino and ultrasonic sensors. The requirement analysis and the system design details have been conducted in depth for the better understanding of the project and also to know risk factors that will be faced during the construction phase. From the above analysis we can conclude that the entire system can be built with low cost, reliable instruments there by providing an efficient Water Level Monitoring System in Water Dispensers.

ACKNOWLEDGEMENT

Authors would like to express gratitude and thank Smt. K. S. Rekha, Associate Professor, Department of Computer Science, The National Institute of Engineering, Mysore for her guidance and supervision.

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