

Water Level and Leakage Detection System with its Quality Analysis based on Sensor for Home Application

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Abstract - Water is one of the basic need of human beings. They make a use of water for various daily activities. Water is pumped from ground storage to fill the top tank. The utilization of non-automated switch used to turn on and turn off a pumping machine, sometimes causes either the water overflow or a wastage of electrical consumption. The proposed system which indicate user about the level of water in tank which makes a use of microcontroller and notification is given through mobile network on mobile. Water quality (i.e. chlorine concentration, salinity) is measured, if it is less than or more than normal values then notification is sent to user as SMS. Leakage detection takes place by using the pressure sensors which detects the pressure of flow of water. If there is a low pressure then it notifies the user by calling on mobile similar to water level detector notification. It helps in saving a water and electrical consumption too.

Key Words: Wastage of water, mobile calling and SMS, Chlorine, pressure sensors.

1. INTRODUCTION

Water is the most important natural resources in human's life. Human needs the water in almost all daily activities such as washing, cleaning, taking a bath, the irrigation, and the industry needs. However, the amount of clean water is decreasing, whereas the number of people in the world are always increasing.

Water a precious thing required everywhere, but because of its excess use the time says to use it carefully so that the next will faced minimum problem. Our world and community is facing excessive water usage either for domestic or commercial purposes and it is a serious issue, which affects the sustainability of our environment. Water shortages or scarcity may be caused by the current climate change, such as altered weather-patterns (including droughts or floods), increased pollution, and increased human demand and overuse of water. As water is one of the scarce natural resources, it is important to properly use and manage our usage in different sectors.

If we keep wasting water continuously it can be very dangerous problem in future. We should start saving a water from ourselves. There are various ways through which water get wasted. Consider a situation where water overflows when tank get full. so our approach is to reduce the wastage of water in this situation. Also, leakage is another concern i.e.

whenever there is leakage somewhere we couldn't get it in initial stage but when it becomes a huge problem it causes large wastage of water. So it is better to take action immediately as soon as leakage takes place.

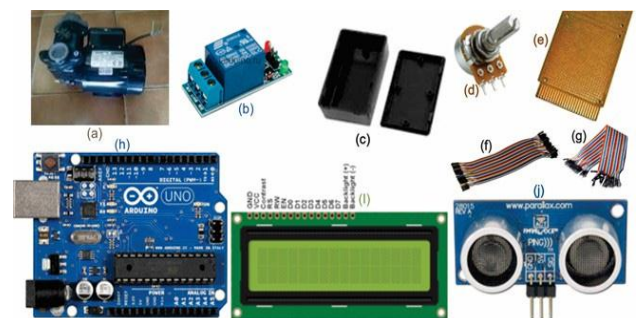
In this paper the development of a wireless, multi-sensor network for measuring the level of water in tank and detection of leakage. All the data from the sensors are processed and analyzed, and transmitted wirelessly to a notification node.

The rest of this paper is organized as follows. Section II reviews the related works that were investigated. Section III describes the body of work. Section IV consist of conclusion and references are available in section VIII.

2. RELATED WORK

1) Automatic water tank filling system controlled using Arduino based sensor for home application.

The system is Designed by applying Ultrasonic sensor and automatic switch module water flow sensor and Arduino microcontroller and pumping machine in order to automatically switch the water filling.



Materials used to construct the automatic water tank filling system prototype. The materials are (a) a water pump, (b) a relay SRD-05VDC-SL-C,

(c) a home-made plastic box, (d) a 10 kΩ potentiometer, (e) a printed circuit board (PCB),

(f) male-to-female cable, (g) male-to-male cable,

(h) An Arduino Uno microcontroller,

- (i) An LCD 16 × 2 display, and
- (j) An ultrasonic sensor HC-SR04 module.

It can help people to analyze water consumption. The prototype can be used to handle the water pump problems.

1) Innovative shunt measurement for residential micro leakage detection.

An innovative micro-leak detection system for domestic applications that utilizes an ultrasonic flow meter in a new shunt configuration is proposed.

The micro-leak detection system is completely Automated as it employs a: USB-powered voltmeter, USB-powered flow meter and USB-powered switches.

This system circumvents water leaks on any scale, anywhere in the world.

The paper briefly reviewed existing water leakage detection methods and urged on the need to improve highly-sensitive water leakage detection techniques. In addition, remotely accessed experiments investigated the aggregations of water leakage and suggested that the total annual leakage at a rate of 3 mL/m is almost equal to two thirds of the average daily usage per capita in the UK. Further research will investigate remote monitoring of water consumption and leakage in agricultural and industrial environments.

1) A design of water tanks monitoring based on mobile devices.

In this paper, an implementation of a system to monitor water tank levels is presented. The system is called: Interface for Monitoring water tanks (IRMA) and consists of the following modules: 1) a set of electronic components consisting of one ultrasonic sensor (US) installed in the water tank, bound to an Arduino Microcontroller Board (AMB), connected to 2) the application service installed in a Server Machine (SM) to receive and manage the measurements of the water tank levels, to advise 3) the Mobile Interfaces.

The main purpose of IRMA is to automate the control of water tank, such as filling and monitoring commands.



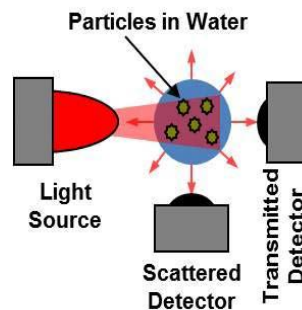
IRMA architecture

When the user receives the notification message (via SMS or PNS), usually the user might response in a matter of seconds. If the user does not provide a response, then IRMA system is able to act on behalf the user, by closing the water supply. This task is possible due to an electric actuator to open or close valves, in order to control the flow of water and if a leak is detected, then the system can prevent the waste of water, to avoid further losses.

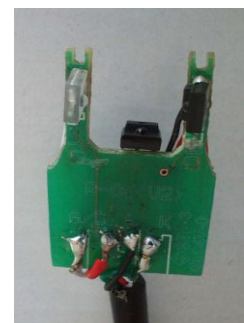
4) A Low-Cost Sensor Network for Real-Time Monitoring and Contamination Detection in Drinking Water Distribution Systems.

The system architecture is comprised of the following three subsystems: a central measurement node (PIC32 MCU based board) which works as a sensor node that collects water quality measurements from sensors, implements the algorithm to assess water quality and transmits data to other nodes, a control node (ARM/Linux based platform) that stores measurement data received from the central measurement node in a local database and provides gateway to the internet, visualize data (charts), and sends email/SMS alerts and finally a tiny notification node(s) (PIC MCU based board) that receives information from the central measurement node through an interconnected ZigBee RF transceiver and provides local near-tap notifications to the user (water consumer) via several interfaced peripherals (LED, LCD, Buzzer).

Turbidity sensor:



a) Measurement principle.



(b) Probe board.



(c) Flat surface PTFE housing.



(d) Inline Tee fitting.

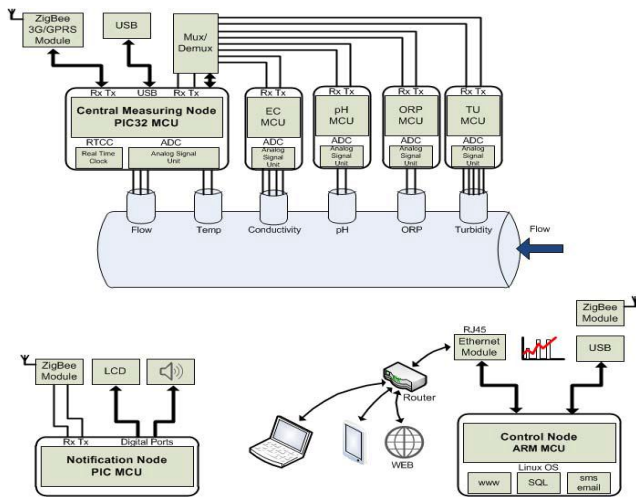


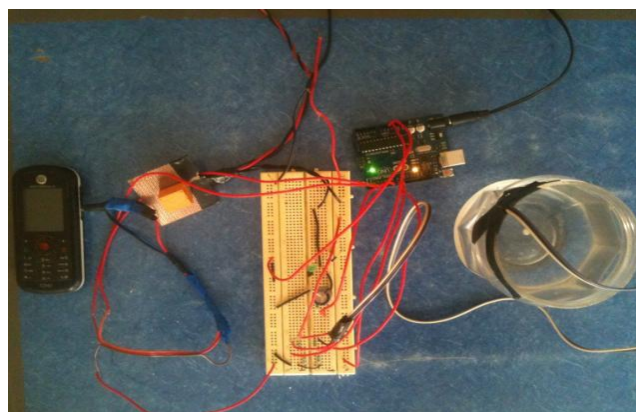
Fig. 1. System architecture.

Two event detection algorithms were developed to fuse on-line multi-sensor measurements in order to assess the water contamination risk when anomalies are detected. The objective of the event detection algorithms is to activate an alarm when normalized sensor outputs exhibit sudden and significant changes w.r.t drinking water quality standards. The first event detection algorithm is denoted as Vector Distance Algorithm (VDA), and the second event detection algorithm is denoted as Polygon Area Algorithm (PAA).

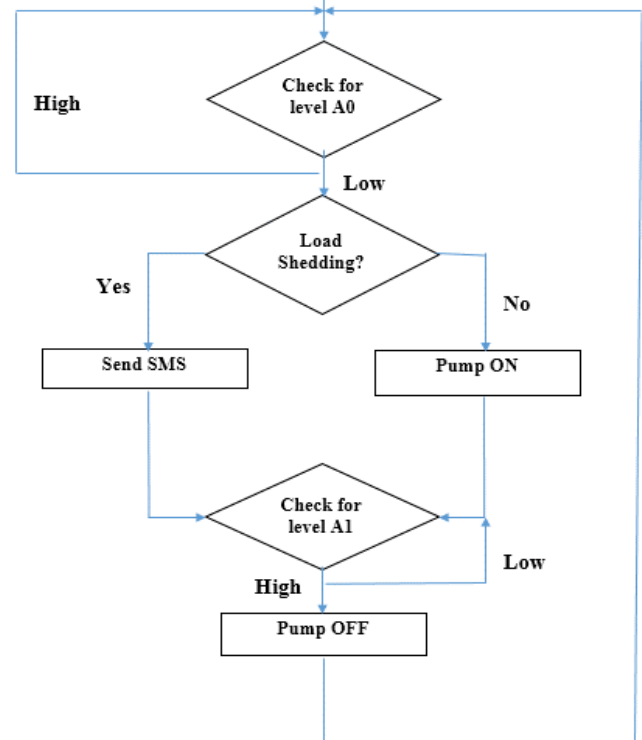
PIC32 MCU based board that collects water quality measurements from sensors. The developed system is low cost, low power.

4) Automatic Water Level Controller with Short Messaging Service (SMS) Notification.

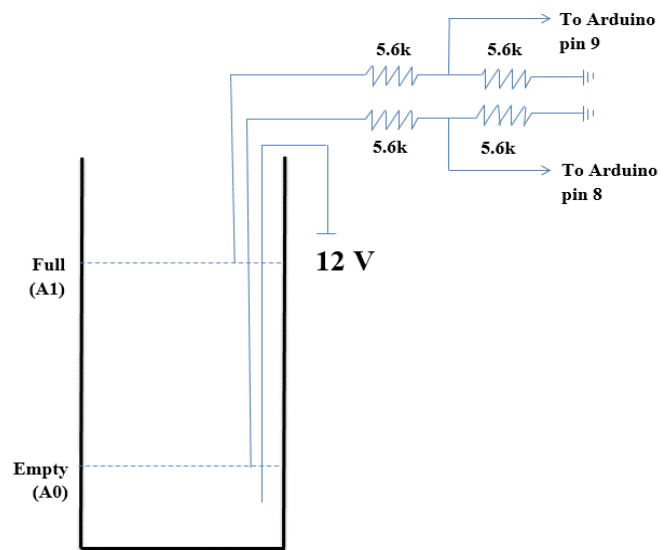
System runs on battery power and comprises of four sub circuits working synchronously; sensor circuit, controller circuit, SMS circuit and relay driver circuit. Sensor senses the level of the water in tank which is continuously fed to controller system. As the system encounters the empty level (A0) condition, status of load shedding is checked. Relay coil is energized and the pump operates when there is no load shedding. SMS is only delivered if status of load shedding is encountered by the controller. Pump stop when the tank is full (A1). Arduino Uno, an open-source electronics, was used as controller of the system



Working system



Flowchart of the system



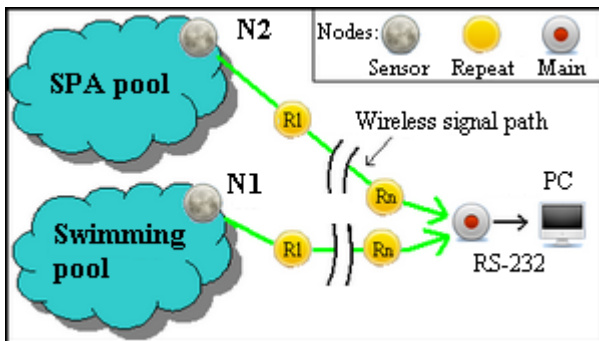
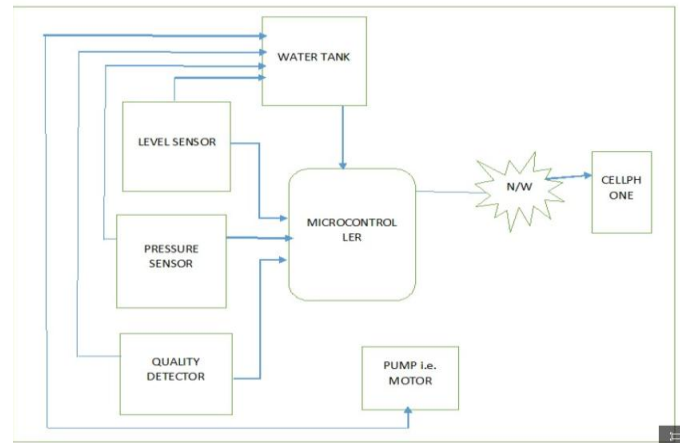
Sensor circuit

This system is deprived of any sort of noise and has effective switching action. The automatic water level controller system can be used in home, office sectors, swimming pool and even in industrial areas. Extra care needs to be given as water is used as conducting media.

4) Design and Implementation of Low Power Wireless Sensor System for Water Quality Monitoring.

The proposed wireless sensor system was composed of TB88-30 (Step Up DC to DC Converter), MPC82G516A (8-bit Microcontroller) is used to control the sensor devices to

acquire the water quality parameters, and input voltage of TB88-30 by the using of ADC. It is also used to control nRF24L01, to perform receiving and re-transmitting of wireless signal. PIC12F629 (8-bit Microcontroller) PIC12F629 here is programmed as a timer. When MPC82G516A and nRF24L01 are both in sleep mode, PIC12F629 starts to count until 5 minutes. After the counting is finish, PIC12F629 will trigger the external interrupt pin on MPC82G516A, wake up the MPC82G516A and return the nRF24L01 to normal mode., and nRF24L01 (2.4GHz Wireless Transceiver). The input range of TB88-30 is from 0.9V to 3.0V, output voltage is fixed to 3.0V. Repeat node does not connect to any sensor device, but receives and transmits only.



3. BODY OF WORK

This idea consist of three different modules which consist of water level detection, leakage detection and quality analysis. The proposed system consist of Arduino microcontroller, Level sensor, Leakage sensor, Cell phone for getting notification.

Whenever tanks get empty or full the level sensors will sense the level and notify the user accordingly. A recorded message will get hear by user.

Similarly, if there is different water pressure different than normal or regular then it will detect it as leakage.as water is treated before coming to our home with the help of some chemicals like chlorination. Also some salt is present in water which is required but, it may happen that water will consist more chlorine or there may be more salinity. This may affect the human health so this system help to analyse the concentration of chlorine and salinity in water.

Here, both leakage and quality (i.e. chlorine and salinity) analysis notification is sent on mobile through SMS only when leakage, more value of chlorine and salinity get detected.

4. CONCLUSIONS

This system will detect water level in tank and accordingly notify the user by calling on mobile so that user will turn on or off the pump. This will keep the user free. Also leakage system will notify user as soon as it takes place will help to recover further big problem. And analysis of water will help to keep health of user secure.

As various system use LED or buzzer system for notification purpose which lead to noise. Also when there is no one in house then buzzer is no use. This problem is solved in this system with the help of use of mobile. It help to reduce wastage of water basically, and electricity too. And takes the care of user's health.

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