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Embedded IOT Based Water Supply Distribution System for Suburban Area: A Survey

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Abstract: Our system majorly is concerned with dealing the water distribution in an efficient way without any human errors. This facility mainly deals with automatic water theft and leakage monitoring which is of major concern in a developing country like India. Other than above dealt problems we have other problems such as consumer's water consumption bill which needs to be handled in an automated way, our system aims at giving the consumer's bill to the owner at the month end using an IOS/Android application

Keywords: Global Positioning System(GPS); Global System for mobiles (GSM); Programmable logic controller (PLC).

I. Introduction

Water is an essential component present on the Earth. The Earth comprises 75% of water. But the drinking water available for consumption is very less and is around 10% of 75% water as major water is available as sea/ocean water which is hard to consume as it is saline in nature. Henceforth water supply distribution to mankind is the major issue concerning whole of the world. The drinking water distribution facility in developing countries like India is very erroneous as it involves theft and leakage in the water driving lines. Another major concern is the control of the lines is done through man power which isn`t efficient as it takes lot of time for switching on and switching off the valves, hence only one locality gets bountiful of water rather than other. our system tries to give an efficient system which resolves all the problems stated above at its best.

II. Literature Survey

Amrit kumar et al. [1] proposed an idea which deals with the monitoring the water in an overhead tank as well as in the underground sump by using an Arduino Uno, ultrasonic sensor and relay. This system switches ON the motor on when the water in the overhead tank is unavailable and switch OFF once the overhead tank is full.

Muktha Shankari K et al. [2] developed a system which provides wireless facility which uses the trans-receiver fixed in both sump and overhead tank and RF communication which monitors the water flow between sump and tank. Based on the water level in the tank motor connected to sump is controlled.

Pranit Vijaykumar et al [3], developed a facility wherein theft of water aswell as water monitoring is done between sump and the main line. The proposed system uses raspberry pi along with ArduinoNano which communicates with cloud using IOT. If the water is less automatically GSM message is used to turn on valve. The flow sensor is used to detect theft of water.

Ejio for Virginia Ebere et al. [4] proposed a system where the water level in overhead tank is measured by comparing water levels present in the copper rods dipped in tank. Based on voltage level, motor of sump is turned ON and turned OFF.

T. Baranidharan et al. [5] the proposed system is used for the water distribution equally to all the streets water pipe line by setting a fixed point to each pipe. The system consists of a pump, PLC, SCADA, level sensors flow sensors and solenoid valve. First the level sensor is used to measure water in the tank and flow sensor to measure rate of flow of water. The buzzer which is connected to the level sensor is used give an alarm when the set point is reached. Solenoid valve is used to automatically open and close the valve. The system consists of 3 solenoid valve. The main voltage 230V is given to the main solenoid which is connected to PLC and output of which is given to the other 2 solenoids. Hence if either of them or both solenoids reaches set point the main solenoid valve is turned off and will be turned ON after 24 hours later. The pump will be turned off with the help of PLC. If the water is not sufficient in the tank the pump will be turned on.

Vardaan Mittal et al. [6] proposed system is an Arduino based automatic water level controller used to avoid the manual control of the motor. The water level in the tank is measured using ultrasonic sensors which work on the principle of echo. The sound waves which are transmitted return after striking an obstacle using this principle it is possible to calculate the time of travel for outgoing as well as returning therefore the distance. The motor pump is automatically turned ON when the water level is low in the tank. The proposed system

automatically monitors the water level in the tank and hence triggers the relay and hence turns ON the motor. LCD is in turn used to display the water level content and status of the motor.

Erua J. Band et al. [7] proposed a system that aims in providing a systematic control of water being pumped to overhead tank when empty and automatically stop the pump when the tank is full. An over load relay is used which senses the presence of excess current and disconnect the supply of water using principle of floatation. This is to avoid the spilling of water at domestic and industrial usage. The water level in the tank is detected by float switch. This switch may be used in a pump, an indicator, an alarm, or other devices.

S.B et al. [8] proposed a system for monitoring overhead tanks. Nowadays, overhead water tanks are being installed in most of the houses. Monitoring these tanks is difficult as they are being kept at the terrace. The proposed system is used to control overhead tanks by a motor which pumps water from sump using 8051 microcontroller unit. Accordingly, an ALP program is developed to control the overhead tanks both modes automatically and manually. A logic control is designed to select fill a particular tank to a desired level. An alarm is employed to prevent the overflow of the water. The proposed system also provides an option of filling all the tanks sequentially and even the desired tank can be filled by turning ON the specific motor. The LCD is interfaced with 8051 MCU gives necessary instruction to operate the system thus monitors the whole system.

Gowtham. R et.al [9] proposed system works on a SCDA based design where the PLC can be loaded with the programs needed and the water theft is found out by placing two flow sensors and finding out if both are having the same values, plus the system controls and monitors everything from the river to the door step for seamless transmission of the water from source to destination. It also uses GSM technology to alert the concerned authorities about the theft and leakage in the system. They have placed power generator turbine in the system which intern produces electricity which operate on the head pressure provided by gravity hence no energy is wasted here and no pumping is required.

E.Vinothiniet al [10].proposed a system where all the tasks are done on micro controller using an appropriate sensor such as flow and PH sensors and the automated task is accomplished by setting a pre fixed value to each house and monitoring it constantly, this overcomes the water consumption issues and ensures even distribution of water to each house and also the PH sensors take care if there are any water quality issues. If there is an over usages of water, the supply is automatically cut and the concerned personal is notified. The communication here is done by using Zigbee module.

Olufemi. O et al.[11]have fitted LEDs for indication of the waste level and they have used copper for water sensing and based on the appropriate scenario the motor will be turned ON and OFF.Relays are used to turn the motor ON and OFF. Softwares used to implement the design is Proteus simulation software (software has two environments; the ISIS and the ARES environments). All the results are simulated using Proteus and AVR Studio Hardware implementation.

N.B. BHAWARKAR et al [12]. The systems work on a threshold limit and has a flow sensor which monitors it completely if there is a drop in the flow rate then it notifies the appropriate authorities that there is a theft or leakage and the communication is done by GSM module.

Table I. Comparision of Existing Water System

Sl. No	**Methodology**	**Advantages**	**Disadvantages**
1	the overhead tank and sump are monitored using Arduino unit	simple design	it uses ultrasonic sensor which does not detect the water efficiently
2	This system maintains wireless communication between sump and tank and monitoring the water	wireless communication	this does not detect the leakage in transmission pipes
3	This system establishes IOT link between raspberry pi and main line and monitors the water based on GSM message	this detect water theft	this system does not detect leakage
4	here water level in sump and overhead tank is monitored based on voltage level of copper rod	design is simple and cost effective	water leakage is not efficiently monitored

5	level sensors determine the state of the water level in the tank and controls the turning On and turning Off of the solenoid valve using PLC.	flow sensors determine the rate of flow of water hence water thefts can be determined	fails to implement automatic water usage bill
6	uses ultrasonic sensors to determine water level and automatically controls the motor depending on water level in the tank.	simple design	fails to determine any water thefts
7	uses principle of flotation to turn ON and turn OFF of motor	avoiding water leakage in industry and domestic usage	complexity in design and expensive
8	8051 microcontroller interfaced system controlsthe turn on and turn off of motor. LCD displays the status	monitoring multiple overhead tanks	fails to detect any water thefts
9	addresses the proper management of the entire system by scada,using scada, plc, gsm system, and to find out theft they are using flow sensors and by variations of water trust they are detecting water theft	And even a simple lay man can understand and operate it	it's complicated from a designer's point of view and must be setup up by a person who has knowledge about it
10	the proposed system deals with quality assurance, flow monitoring and the automated supply of the water so that the waste isn't wasted and this is implemented by using slow sensors and pH sensors	uses PIC family processors hence components arecheap, and over all problems are Dealt here	it's done on embedded C
11	this paper deals with the automated controlling of the motor s so that the life span of the motor is increased, and the water wastage is during transmission is reduced by automated control of the motor, the water level is measured here by using ultrasound for level detecting, and they are using DC power throughout hence electrocution by any means is avoided	since the motor is controlled by the microcontroller human intervention if removed and the complete process if automated thus improving the efficiency of the motor, and also the system is made to work on DC power hence electrocution is s avoided	programming the microcontroller would be a bit difficult based on the level sensed using copper conductors

12	the paper deals with water theft and ensures the proper distribution of water using embedded system's and uses arm processors	simple and cost effective	need more improvements

III. Proposed System

Based on the earlier studies carried on various methods of Water controlling and monitoring system, a more effective architecture of embedded system based water system is put forward in this section.

The proposed water distribution system consists of three embedded system placed at dam,substation and local area. The system placed in the area consists of sensors which are connected to the sumps and overhead tanks of each house of the respective locality. This system monitors the valves of area and organizes efficient distribution of water in the locality.It also informs the unavailability of water in the area to the substation.This system monitors the thefts and water leakage to substation. The substation is an interface between the main dam and local area which monitors the monthly bill and delivers the bill to consumer using the IOT and distributes water to the local substations and manages the water distribution. This system involves the flow and pressure sensor to monitor the theft, leakage and for determining the consumption of water by the consumer.

A. Arduino UNO:-

Arduino is a open source computing platform which is fueled by the user community. They manufacture single board microcontrollers kits, the hardware and software are open source and the user can customize it to his requirements Arduino UNO- It is a microcontroller based board which runs on a ATmega328P chip, which operates on 5Vts DC. it houses both digital and analog pins for input and output operations (out of which 16 pins are used for digital and 6 for analog). It has a 16 MHz quartz crystal, SRAM of 2KB and Flash ROM of32KB

B. EPS Module (8266):-

It's a inexpensive module which allows the microcontroller to connect to the internet through WIFI network and make simple TCP/IP connections. It works on a 32-bit RISC microprocessor which has 1MB of built in Flash and has IEEE 802.11 b/g/n WIFI standards.

C. Moisture Sensor:

Moisture Sensor is a device used to measure the moisture content in the place being used. It works on the principle of conduction, when the water comes in contact the circuit is complete and the digital output of the sensor is read and analyzed

D. Solenoid Valve:

Solenoid valve is basically a normal valve where the valve is controlled electrically by passing small current to open or close the valve. They are fast, reliable, and long lasting and are easy to use.

E. Submersible Pump DC:

Supersensible pump works like another suction pump, but here the entire body of the pump is submerged inside the water. The main difference between the conventional pumps are that submersible pump push the fluid to the surface where are the normal pumps pull the fluid to the surface. It works from 2.5~6v power supply which can handle up to 120 liters per hour with a low power consumptions 220mA

F. Relay:-

Relays are basically an electrical operated switch which works on the electromagnet to operate the relay mechanically. It can handle large amounts currents. Where we give small input control signal to control the switch

G. OR gate:-

OR gate is a digital logic that implements logical disjunction. It follows the truth table as shown

A	B	Y
0	0	0

0	1	1
1	0	1
1	1	1

H. Flow Meter:-

Flow Meter measures the flow of water by using the flow sensor, which has a turbine inside and the amount of the flow rate is obtained and amount of water is calculated. Here the speed of the water is directly proportional to the flow sensor output

I. Pressure Sensor:-

This device senses the water pressure which is used as a time constraint monitoring device

J. 1/4th inch tube:-

The tubes are used for routing the water from one place to another

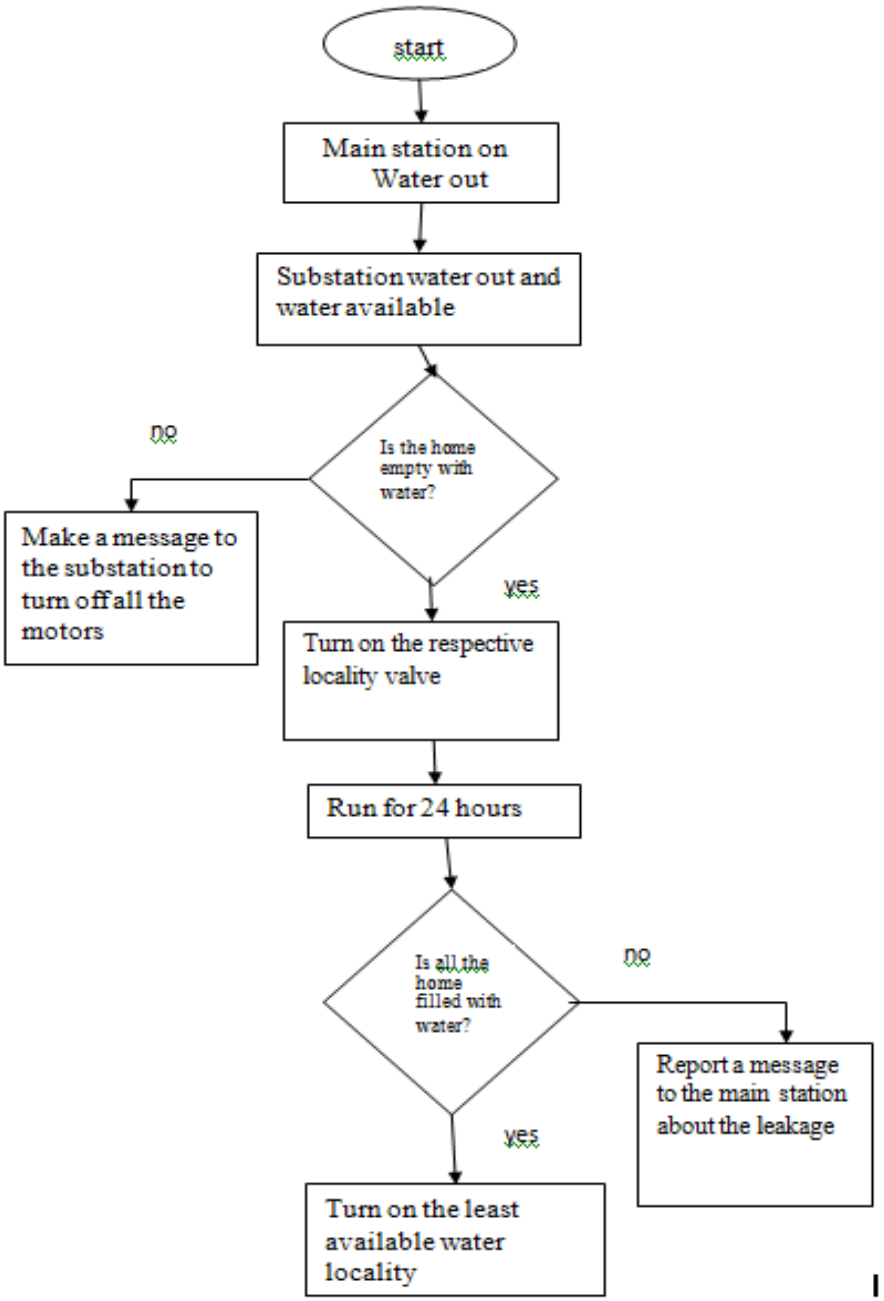

Fig. 1. Sample images chosen during Registration phase

IV. Conclusion

The system proposed above tries its best to distribute the water for sub urban area without any human interference.

This system tries to detect the theft and leakage in the lines and try to inform it to nearby consumer as well as substation.

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