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A New Framework for Water Supply using IoT Technology

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Abstract: ***As the population keeps growing, water source must be distributed efficiently. The objective is to design an IoT based system which supports to monitor and control the water distribution to each home without any human intervention at the first level of initiation. In addition, the system will also help us to identify the leakage in the pipeduct so as to carry out immediate rescue against to the water leakage along the pipeduct. Later on, this idea will be upgraded by incorporating with necessary features for the common usage. The system consists of sensor nodes to note the quantity of water in every house by flow sensors at each instant and sends the data to the cloud using Wireless communication. The information collected could be known by users on the integrated website using their wi-fi connected gadgets slike mobilephones.The device also controls the automatic functioning of water supply by turning it off when the water rises above the high level than allocated to the appropriate huse which was initially fixed by government boards.***

Keywords:IoT,Globalnode,Distributednode,Node MCU.

I. INTRODUCTION

Water is a crucial resource for all the livings on the planet. In that, some people aren't getting required amount of water because of unequal distribution. The distribution system can use this new framework in order to get the sufficient quantity of water equally.It is additionally accustomed to avoid the wastage of water throughout the distribution amount.In the existing method,the worker needs to go to the specified place for opening the water valve and shuts off the same after some duration.It requires time and supply excess or less quantity with respect to different population in individual homes.

This proposed system is fully programmed,mechanized process.Here requires comparatively less human work and time.To ensure the safe provide of water quantity, the amout delivered to each house should be monitored in real time.For that purpose,new approach IOT based water quantity observation has been proposed.This technique consists some sensors that measures the water quantity parameter. This observation of water resources info can profit the water resources maintainance,departments and thus public .

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II. SURVEY ON EXISTING SYSTEM

A. Problem Statement

Water is important for all notable kinds of life that covers seventy one of the Earths surface. On Earth, 96.5% of the planet's water is found in seas and oceans, 1.7% in groundwater, 1.7% in ice and 0.001% within air as vapor.Only 2.5percent of the Earth's water is water, and remaining of that water is in the form of glacier & groundwater.India has quite 1200 million individuals residing in concerning 1.5 million habitations adjoin completely different states of our country.In 2020, India is known as a 'water stressed' country because of non-uniform distribution of rain across the states likewise as ineffective utilization of the water resource by the house owners. Meeting the water wants for quite 1200 million individuals in future are going to be a extremely difficult task[3].

The distribution of provide of water isn't uniform in nature to every town of our country conjointly too. Moreover, most of the house owners consumes large quantity of water victimization booster pumps illicitly connected by the house.Still now, there's no monitorization for the usage of water by the individual homes and there's no adequate asking system for it. This successively causes the imbalance in effective utilization of the water resource economical manner. To start out with, the importance was on putting in physical infrastructure in variety of hand pumps.

B. SMART WATER MANAGEMENT SYSTEM

Intelligent observing is categorized as a method which is used to track, manage, manipulate and amend the network via the use of distinctive computational techniques with a purpose to provide clients with respective gear and information . The Internet of things (IoT) develops an major part of smart observing which connects human and gadgets the usage of wi-fi sensor technology[4]. The Cloud computing is rapidly turning into an progressive and clean version for turning in the IT offerings in conjunction with dynamic infrastructure. Cloud computing makes use of Internet as communique media.

It is also reworking new concept to have centralized utility and database servers. Water is a most essential sources and treasured gift by nature on earth. It required in all fields viz. Industries, Agriculture, Irrigation, Domestic use, Plantation, Recreation, Wildlife etc. Water is in limited resource and requires proper management. The advancement of Information and Communication Technology has appreciably adopted for management of water assets[5].

The sensible water using devices embody water pipeduct observation, water standard in public water supply, sensible meter measuring,IoT certainity for sensible water system(SWS) etc. so as to confirm the unification of client info, protection of the devices and information felt the network,aframework and processes were enhanced.Water standard observation of open water resources was another application that was enforced victimisation IoT devices. It helps to protect the water standard and prevent the health of the economy victimisation in expensive tools and create a network virtual platform rather than usual.Another application enhanced due to the expansion of IoT was duct outpouring observation and indication.Entirely distinct IoT supporting materials, Wireless Sensor Networks and cloud service were used to detect and alarms the user regarding the duct outpouring as a result of an large quantity of water wastage is happening through outpouring.An answer to the contamination issue of the WSN has been created doable by Internet of Things-cloud union.

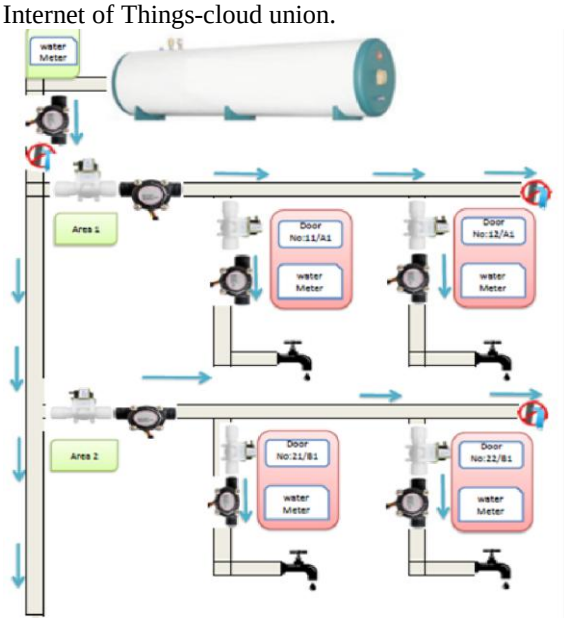

Fig 1.Functional Diagram Of The Framework

The utilization of cellular rules, reciprocal action acquinting policies and bunch ways are need to gather and maintain sensor information through the usage of cloud. Victimising these ways, the sensor information are going to be passed on into the cloud utilizing unique protocols and thus providing network firmness.

The major applications that this system deal with in,

- Water tank quantity manage
- Fuel tank extent computation
- Oil tank amount management.
- High & low degree alarms.
- Pool water volume management.
- Cooling tower water magnitude control.
- Sewage pump quantity control.
- Remote liquid monitoring.
- Pump controller
- Stream extent observing
- Tsunami warning and sea measure observing
- Process batch control & observing.

III. FUNCTIONAL CHANGES IN THE EXISTED SYSTEM

•The admin is allowed to access the webpage so that he can allocate the required amount of water to each house and add some more houses under the distribution system if necessary.
•The users can view their database in the webpage from anywhere using their unique ID.
•When the amount of water supplied to that house reached the limit then it is sensed by the flow sensor which is fed to node MCU. There the data is processed and the decision will be taken place depending on the result.
•If the level reached the limit then it is transmitted to relay circuit where it closes the solenoid valve or else the supplying action continues.

A .Block Diagram Description

Water flow Sensor - As the name water flow sensor is a device to measure water flow. After calculating the water flow it opsends it to arduino.
NodeMCU – Node MCU is a publicly available IoT platform. It consists of microcode which supports wifi module in nodeMCU System On Chip espressif system, and h/w which is based on the ESP-12 module. NodeMCU is used to control the function of water flow sensor. It receives data from water flow sensor.
WFS is attached to NodeMCU.The output of water flow sensor is given to is given to nodeMCU for the purpose of display. WFS continuously calculate the flow of liquid and calculated data is send to nodeMCU.

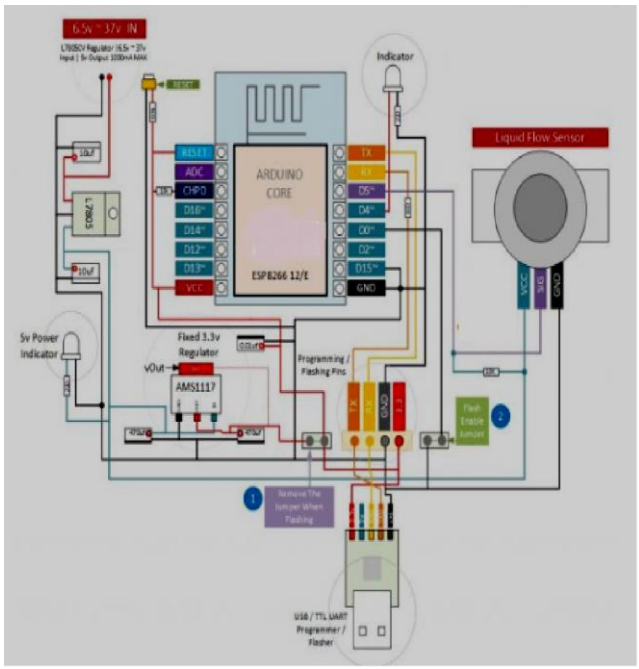

Fig 2.Connections In Single Sensor Node

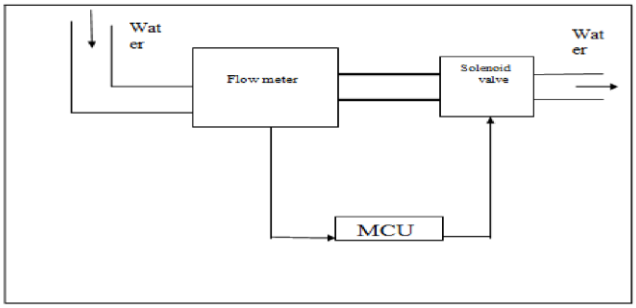

Fig 3.Schematic Of A Sensor Node

•Litres numeration within the serial monitor of the Arduino IDE;

•Setup of a webserver within the ESP8266, wherever the information from the cubic decimetre consumption is shown in response to associate HTTP request. The access to the webserver may be done within the network or from outside, requiring the corresponding setup of the Wi-Fi router.

•Through associate HTTP GET request, the entire variety of litres is sent to associate HTTP server.

B.Flow Sensor With Aurduino

When water enters the turbine rotates, the magnet comes and hall-effect sensor comes into close contact.A series of pulses is then read from the hall-effect sensor whose frequency is analog to the rotation of the turbine.Since the flow sensor generates a pulse on every occasion the magnet aligns with the hall effect sensor, we are ready to use this pulse as an interrupt trigger.The OUT pin of the water flow sensor is attached to 2nd pin of the Arduino which is connected as an interrupt to pin 0.Then, on the interrupt subroutine, we sum up the pulses and divide that sum to 40.The quantity of water is now known.1 liter of water is adequate 40 pulses.Have to determine the time between pulses using the millis() function. The water flow rate would then be:

WATER FLOW RATE(L/min)=(1L/5880 pulses)*(1 pulse/pulse width in minutes)

Now ,we are supposed to measure the amount of water consumed by adding the water supplied in total litres.

```
FlowRate = ((1000.0 / (litre() - oldTime)) * pulseCount) /
        calibrationFactor(4.5);
oldTime = litre();
Flow Litres = (flowRate / 60) * 1000;
Total Litres += flowMilliLitres;
```

Now the total litre will be seen by the users by logging in through their USER ID.

Table.1.Water Status On Level Supplied

Sl.No	Conditions of water level	status
1	When the water level is below a minimum level	water continues to flow.
2	When the water level is above the maximum level	valve closed.supply of water stops.
3	When the water level is in between maximum and minimum level	It can be controlled by a user

1V. NODES AND RESOURCES

Based on the availability of water resource, the distributor node will be programmed by the global node. Each distributor node will be programmed in timely manner depending upon the water resource availability.The water from the water tank is distributed to each house via a global node. Each house consists of a node having unique ID. Each node is connected to the central hub, which is in turn connected to the local server. The data from the local server is to be updated in the database of cloud server periodically. The users can view the webpage of water utility report anytime by allotted user ID. Distributed nodes mean nodes which are located in water inlet of various Houses in the department.

A.Distributed Node And Its Function

The distributor node contains a processor, flow meter and valve unit. Water first enters into the flow meter. Flow meter senses the amount of water flowing through it. The data from the flow meter is processed using the processor as per the functionality. The processor checks the consumed amount of water with the predefined limit regularly. When the value exceeds the predefined limit, the processor controls the valve to stop the flow of water.

The water consumption quantity is then and there updated into the cloud via local server. Any time the consumers can view the amount of water consumed by them and also can check the availability of water allocated for them.

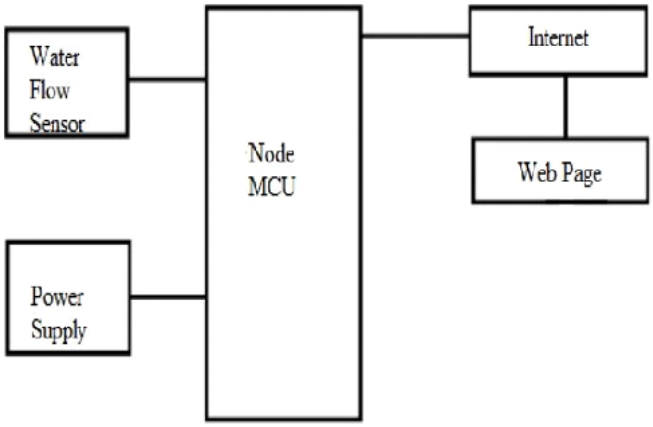

Fig 4.A Sensor Node-Block Diagram

B. Global Node And Its Function

The Global node is the node connected at the outlet of the water tank from where water gets distributed to all houses via distributed nodes.Global node also consists of flow sensor, processor and connection to the hub. The global node differs from the distributed node only by its functionality. Global node gets the command from the local server and verifies the total amount of water send through global node which should be equal to the sum of water quantity through the distributed node.The global node water consumption reading and sum of the reading from the distributed nodes are compared in the local server to find any malfunction or leakage in the pipeduct.To implement this specific characteristic of the local base station server.

C. ESP8266 Wifi Module

The ESP8266 wireless local area network Module could be a self contained system on chips with amalgamated TCP/IP rule piled in an effort to provide any microcontroller for getting access to WiFi network. It has high durability that it is capable of functioning systematically in industrial environments,because of its huge operational temperature vary. With highly-integrated on-chip options and tokenish externally distinct element count, the chip offers reliability, compactness and hardiness.ESP8266 reaches low power consumption with a mix of many proprietary technologies. The power-saving design options 3 operating modes: sleep, deep sleep and active mode. This permits powered styles to run longer. Every ESP8266 modulecomes pre-programmed with AT command set firmware, meaning, which allows to merely hook this up to processor and obtain the results regarding the maximum amount wireless local area network-ability as a WiFi protect offers. The ESP8266 module is a totally valued effective board with a large, and ever growing, community.

This module consists a strong enough on-board process and storage capability that allows it to be integrated with the sensors and different application specific devices through its GPIOs with minimal development up-front and minimal loading throughout runtime. Its high diploma of on-chip integration permits for minimal external electronic equipment, as well as the front-end module, is intended to occupy minimal PCB space. The ESP8266 supports APSD for VoIP s and Bluetooth co-existance interfaces, it contains a self-calibrated RF permitting it to work below all operative conditions, and does not want any external RF components.

V. DATA DEPOSITION, MANAGEMENT AND PROCESSING

A solution to the storage issue of the wireless sensor network has been made possible by IoT-cloud combination. The use of cellular protocols, interaction aware schemes and clustering methods were used to store and manage sensor data using the cloud. Using these methods, the sensor data will be transferred into the cloud using specific algorithms and thus offer network fimness .

Data fusion is another method to manage data in WSN. It is a method of automatically combining data from different sources that helps users to make decisions in many critical environment.This notion has been executed using the least square technique to identify the quality of water usage in houses. It requires more computational power and cost. The data storage and management are applied in the network layer of IoT architecture.

A. Energy Consumption Analysis And Controlling

The power transfer between the sensor nodes is another technological advancement to manage energy in IoT for water distribution system. The thermal or magnetic field will be suitable for the power transfer in determining the water quality in pipeducts. An energy efficient scheduling scheme for power transfer and a wireless power transfer protocol were some of the recent developments in energy management. The wireless power transfer protocol consists of two protocols, one for balancing the energy and the other one for checking the power of each sensor nodes for energy transfer. The research on scheduling is to reduce the energy consumption of the transmitters in software-defined wireless sensor network . This technique could be implemented in the network layer to manage energy in water distribution system.

As the growth IoT is rapidly increasing every year and several IoT architectures has been introduced based on the application. The current water distribution system now uses smart devices, artificial intelligent methods and MEMS which later on could be integrated with energy harvesting methods and more IoT devices, the basic architecture seems to be inefficient to be used in water distribution system with new technologies integrated. So there is a need for more research in creating an IoT architecture to be used in water distribution system.

B.Design Of Resilient Computation Algorithm In Nodes

Wireless Sensor Networks mostly depend on multi-hop transmission to deliver a data packet from source node to a destination node through a group of intermediate nodes. The amount of times for imparting and exchanging information and energy utilization are often reduced by data accumulation operation[8].A number of the optimal nodes within the network are used for data solicitation and to perform data aggregation. On the opposite hand, these nodes may not acquainted with whether they have conglomerated true data or not because the data given by any malevolent nodes in the network which leads to large data-error which increases timing uncertainty and overhead. Due to random deployment of sensor nodes in faraway remote areas. These are susceptible to many security attacks associated with data confidentiality, integrity and authentication. With reference to resource constraints of sensor nodes, traditional security mechanisms don't seem to be suitable for wireless sensor nodes. Considering this, a message digest scheme by means of using maximum period sequence primitive polynomial approach is provided event-driven architecture so on ensure node-level data integrity for time and mission critical tasks. additionally, configurable serial transmitter and receiver blocks were added to the designed block using which data size are often configured as per the applying scenario. The overall performance of this scheme is evaluated and compared with another current processor-based schemes.

C. Future Plans

The technical expertise and domain knowledge gathered from this idea will help to share our experience to product development companies in water management, state government and central government organizations associated with water management services in India. IoT compatible smart water management devices will be introduced to market for revenue generation. The future plan will also deal Big data analytics. Big data is same as that of ‘small data’ but it has bigger data consequently which needs appropriate tools for processing. Many kind of ‘big data analytic’ task is being carried out using publicly available based components. An ordinary data will be considered as bigdata when its volume, velocity, or varieties are too high and in which it is tedious process to process these huge volume of data with timing information.

Several organizations have the tools and expertise to manage high volume of structured data with the faster flow, they lack the capability to "mine" it and derive optimized solution in a suitable time. Since the high volume of this data growing is too fast for specific kind of analytics, the speed with which it arrives and the different range of data types create platform to develop new types of data processing and analytic solutions for this specific kind of analytics.

VI.RESULT AND CONCLUSION

The framework is evaluated by passing a fixed amount of water after setting all the limits in the flow sensor throughout the entire setup. The solenoid valve seems to be closed after the flow sensor reaches its predefined limit. By creating a hole in the pipe between two houses in an area intentionally, the leakage is also found out in an efficient manner by checking the value read by the flow sensor. Thus the wastage of water is completely reduced. The framework doesn't requires any human intervention thereby reducing the human time.

Table.6.1.Result of a single sensor node

VII.CONCLUSION

This logic dealt with finding solutions to an important social problem of effective water resource management system in India which in turn combines Water boards into a single common platform using evolving IoT Technology for the effective implementation of water resource to all common people without any human intervention as per the water resource availability irrespective of time-to-time seasonal changes across the states. This proposed system will develop the basic outline of water management methods by keeping the user up to date by storing the information regularly, received using certain parameters with the usage of network sensors. Thus, by this way user can keep track of the usage of water and plan accordingly the range of water level to be administered. Therefore, this device helps achieve certain level of optimal usage of water which in turn makes water management more effective.

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