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Prepaid Water Meter With Quality Checker and Auto Complaint Generation Using IOT

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Abstract*: Water efficiency is a global concern, and smart water systems aim to achieve maximum water efficiency. A prepaid water meter is proposed to measure water consumption by households, addressing the issue of shared consumption and overpayment. The system uses an IoT design for real-time data collection to monitor water flow, utilization, and quality. It addresses challenges in the water sector, such as flow rate measurement and water supply monitoring. The system uses Solenoid Valve and Turbidity sensors to measure water quality and ensure safe drinking range. Java is used for web applications, while a microcontroller, like Arduino, processes the data. When water quality falls below acceptable levels, the system sends an email alert to the municipal corporation, allowing authorities to address the issue promptly and ensure clean water supply. A MySQL database is used to record customer information, water consumption, and charges.*

Keywords: Turbidity sensors, gas sensors, PH sensors, microcontroller, cloud storage, sensors, Internet of Things (IOT), and solenoid valve , real time monitoring

I. INTRODUCTION

Water is an essential resource for all living beings, and its scarcity is a growing concern due to overuse and mismanagement. Issues such as poor water quality, tank overflows, pipe leaks, and inefficient usage contribute to water wastage. To address these problems, an IoT-based system can be implemented to monitor and manage water usage in real-time. This system includes digital water meters, sensors, and automated controls to track consumption, control flow, and ensure equitable distribution. By using this approach, water wastage can be minimized, and users are billed based on actual usage rather than a fixed rate. This not only conserves water but also reduces costs associated with manual monitoring and maintenance. The real-time data provided by the IoT system benefits both the water management authorities and the public, ensuring a more efficient and sustainable use of this vital resource.

PROBLEM STATEMENT

The Prepaid Water Meter application integrates water utilization and real-time water quality monitoring using IoT sensors. Arduino software is used to detect water flow rate, display output, and send data to the cloud. This smart water management system addresses water wastage, unauthorized consumption, and contamination, providing accurate billing, usage updates, and alerts on water quality.

II. LITERATURE SURVEY

The literature highlights the significance of real- time discovery of E. coli bacteria in gutters using advanced detectors like the ROTEMUS Water Sensor. Traditional styles are time- consuming, but IoT- grounded systems give quick and accurate discovery, enabling prompt action to alleviate pitfalls and insure public health. Research explores colorful technologies to ameliorate discovery delicacy and speed, emphasizing the eventuality of advanced detectors to enhance water quality monitoring and operation.

The literature on IoT- grounded real- time water quality systems emphasizes the significance of covering parameters like pH, turbidity, and contaminations in real- time to insure safe and clean water force. Traditional styles have

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limitations, but IoT systems use detectors, wireless communication, and data analytics to give accurate and timely perceptivity. exploration shows that these systems can descry anomalies, prognosticate contaminations, and enable visionary measures. Studies also explore the use of advanced detectors, machine literacy algorithms, and the integration of IoT with pall computing and big data analytics. Overall, the literature highlights the eventuality of IoT- grounded systems to revise water quality monitoring and operation.

The literature emphasizes the significance of optimal placement of quality sensors in civic drainage systems to covernon-conservative adulterants like bacteria and contagions. Effective sensor placement improves the discovery of these adulterants, enabling quick responses to waterborne outbreaks. Research explores colorful strategies, including hydraulic modeling, detector network optimization algorithms, and machine literacy ways, to identify the stylish sensor locales. The literature highlights the need for a methodical , data- driven approach to optimize sensor placement, icing effective monitoring and operation of water quality in civic drainage systems.

The literature highlights the significance of affordable and effective IoT- grounded water quality monitoring systems. These systems use detectors, wireless communication, and data analytics to give real- time perceptivity, descry anomalies, prognosticate contaminations, and enable visionary measures, all while reducing costs. Research explores cost-effective results, including low- cost detectors, energy- harvesting technologies, and machine literacy algorithms, emphasizing the eventuality of IoT- grounded systems to revise water quality monitoring and operation.

The literature on IoT-based smart water quality monitoring systems highlights the integration of advanced technologies like sensors, IoT devices, and data analytics for real-time monitoring and management. Traditional methods are manual and time-consuming, while IoT systems offer a proactive approach, detecting parameters such as pH, turbidity, and contamination, and transmitting data to cloud platforms for analysis. Research shows that IoT systems improve monitoring, enable early detection of contaminants, and support informed decision-making, emphasizing their potential to transform water management and ensure safe, clean water supply.

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The literature on IoT-based water quality monitoring systems highlights the integration of advanced technologies like sensors, microcontrollers, and communication protocols for real-time monitoring and management. Researchers have explored various designs, sensor types, and machine learning algorithms to analyze water quality data and predict contaminant levels. The literature emphasizes the importance of sensor placement, data transmission protocols, and system scalability. Proposed solutions include optimal sensor placement strategies, energy-efficient data transmission, and cloud-based data analytics. Overall, IoT-based systems have the potential to improve public health, environmental sustainability, and water resource management.

III. SYSTEM DESCRIPTION

Arduino Uno : The open-source electronics platform Arduino is built on user-friendly hardware and software. The microcontroller can receive instructions from a developer. Since all Arduino boards are open-source, users can construct them on their own and modify them to suit their specific requirements. The ATmega328P microcontroller chip is a component of the Arduino/Genuino Uno board. It features a 16 MHz quartz crystal, 6 analog inputs, 14 digital input-output pins, a power jack, a USB port, and a reset button. The Arduino Uno's ATmega328 is pre-programmed with a bootloader that enables the uploading of fresh code.

Flow sensor : Water inflow through pipes can be detected and measured using a device called a inflow detector. Water inflow is calculated by the water inflow cadence in confluence with the inflow detector. The rotor will begin to rotate when the water passes through the blade. Accordingly, the volumetric inflow rate/ aggregate inflow rate via the cadence is precisely commensurable to the affair frequence that beats induce. The Turbine of Flow Meter illustration is displayed in the figure.Water inflow through a inflow detector is measured using a inflow detector. In substance, this detector is

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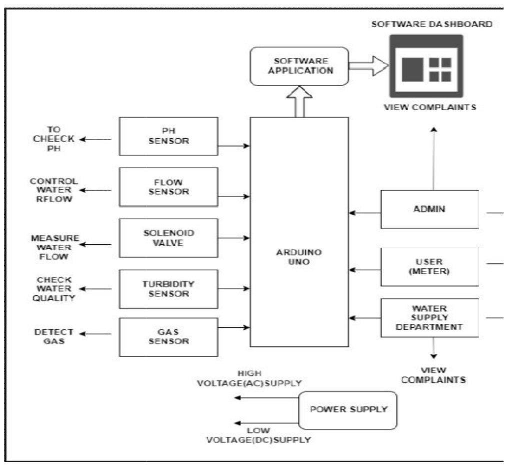
made up of a rotor, a Hall Effect detector, and a plastic stopcock body. When water or liquid passes through the stopcock, the pinwheel rotor rotates, and the speed of the rotor is precisely commensurable to the inflow rate.

Solenoid valve : A solenoid valve, a straightforward electromagnetic device that immediately transforms electrical energy into linear mechanical motion, is utilized as a water regulating valve. A mechanical valve and a simple solenoid are combined to create a solenoid valve. Thus, an electrical solenoid and a mechanical valve are the two components of a solenoid valve. In order to open, close, or modify a mechanical valve, a solenoid transforms electrical energy into mechanical energy. The figure depicts the solenoid valve.

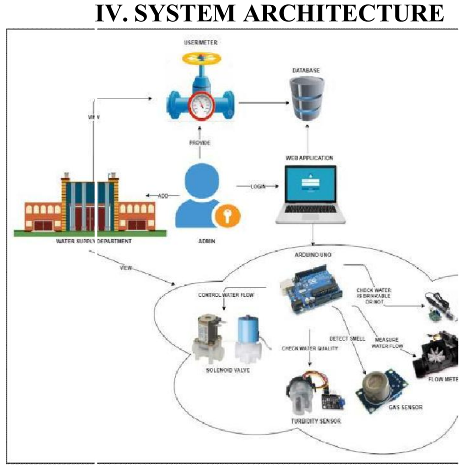
Turbidity sensor : The quantum of light scattered by the suspended solids in water is measured by turbidity sensors.Turbidity detectors are employed in laboratory studies, deposition transport exploration, wastewater and effluent monitoring, settling pond operation outfit, and swash and sluice gaging. The cloudiness of water is measured by its turbidity. The degree of translucency loss in the water has been expressed by turbidity. It's regarded as a dependable index of water quality. Turbidity prevents submerged submarine foliage from entering the light it needs. Because suspended patches close to the face make it easier for heat from sun to be absorbed, it can also beget face water temperatures to rise above usual.



PH sensor : A PH sensor is used to detect the pH value of water, determining whether it is within the safe drinking range (pH 6.5-8.5) and indicating if the water is drinkable or not.

Gas sensor : The sensitivity of gas sensors to carbon monoxide is high. The sensor, which is inexpensive and appropriate for a variety of applications, can be used to identify various gases that include CO. The presence and concentration of different gases in the atmosphere or enclosed places can be determined using a gas sensor. It is frequently used to monitor environmental conditions, safety, and air quality in commercial, residential, and industrial settings.

IV. SYSTEM ARCHITECTURE



The design consists of three modules Hardware Module, Web Garçon Module, and operation/ operation. The Hardware Module includes tackle corridor for controlling water inflow, while the Web Garçon Module includes garçon corridor. The operation/ operation observers water operation, using solenoid faucets and pH detectors. The system is completely automated, saving time and trouble.

V. OBJECTIVE

The objectives are to accurately measure water consumption, display real-time account balances, verify daily usage, provide utility company signals, cut off water when zero credit is present, develop an accurate prepaid water metering system, monitor water quality parameters, detect leaks, and create a user-friendly interface for efficient water management, promoting water conservation.

VI. PURPOSE

The purpose of Prepaid Water Meter and Water Quality Checking using IoT is to design and develop a smart water management system that accurately measures water consumption, detects contamination, and provides real-time insights to consumers and water utilities. This system aims to eliminate manual meter reading errors, reduce unauthorized water consumption, and prevent water wastage, ultimately ensuring efficient use of this precious resource.The purpose also includes providing consumers with a user-friendly interface to monitor their water usage, receive alerts on unusual consumption patterns, and access water quality data, enabling them to make informed decisions about their water consumption. Furthermore, the system aims to enable water utilities to optimize their operations, predict demand, and detect leaks or faults in the network, leading to cost savings, improved customer satisfaction, and a more sustainable water management ecosystem.

VII. AIM

The aim of Prepaid Water Meter and Water Quality Checking using IoT is to develop a cutting-edge water management system that integrates accurate prepaid metering, real-time water quality monitoring, and advanced data analytics. This system aims to provide a reliable, efficient, and secure solution for water utilities to manage their networks, reduce losses, and improve customer satisfaction. The aim also includes enabling consumers to take control of their water consumption, monitor usage patterns, and receive alerts on water quality issues, ultimately promoting water conservation and reducing waste. By leveraging IoT technology, this project aims to create a scalable, adaptable, and user-friendly solution that addresses the challenges faced by the water industry, contributing to a more sustainable and efficient water management future.

VIII. SCOPE

The scope of Prepaid Water Meter and Water Quality Checking using IoT encompasses the design, development, and deployment of a smart water management system that integrates prepaid metering, real-time water quality monitoring, and data analytics. This system will cover various aspects of water management, including accurate consumption measurement, detection of unauthorized use, leak detection, and water quality monitoring for parameters such as pH, turbidity, and contamination. The scope also includes the development of a user-friendly interface for consumers to monitor their water usage, receive alerts and notifications, and access water quality data. Additionally, the system will provide water utilities with real-time insights into network performance, enabling them to optimize operations, predict demand, and improve customer satisfaction. The scope extends to integrating the system with existing water infrastructure, ensuring scalability, adaptability, and compatibility with various IoT devices and platforms.

IX. APPLICATIONS

1. Water Utilities: Companies responsible for providing water services, seeking to improve efficiency, reduce losses, and enhance customer satisfaction.
2. Government Agencies: Municipalities, urban development authorities, and water resources departments, aiming to manage water resources effectively and ensure public health.

3. Consumers: Residential, commercial, and industrial users of water, seeking accurate billing, real-time usage insights, and access to safe and clean water.
4. Water Conservation Organizations: Groups promoting water sustainability, efficiency, and conservation, interested in innovative solutions.
5. Smart City Initiatives: Cities investing in IoT-based infrastructure for efficient resource management and improved citizen services.
6. Water Treatment Plant Operators: Companies responsible for treating and supplying clean water, seeking to monitor water quality in real-time.
7. Real Estate Developers: Developers of residential and commercial complexes, seeking to integrate smart water management systems into their projects.
8. Research Institutions: Organizations focused on water research, development, and innovation, interested in IoT-based water management solutions.

X. CONCLUSION

This paper will demonstrate the successful perpetration of an internet- grounded approach to Prepaid Water Meter & measuring water quality and operation on a real- time base. Detecting poor water quality, the system(exercising microcontrollers like Arduino) sends automated dispatch cautions to the external pot with position, time, and inflexibility details. A inflow detector for measuring of volume supplied, barring the downsides of traditional water metering systems. unborn advancements can include repaid billing and automatic treatment of water grounded on the nature of impurity. Water metering system will be used for automated billing, barring the downsides of traditional water metering systems. This new idea can be further extended to other areas like oil painting and natural gas monitoring systems.

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