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COMPREHENSIVE INSPECTION AND ANALYSIS OF WATER SUPPLY DISTRIBUTION LINES

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Abstract : Water management is very important for ensuring that resources are used wisely in both urban and industrial areas. For industries to work smoothly, they need a steady and well-controlled supply of water. If water use is not regulated or if too much water is used, it can lead to inefficiencies and waste. To solve this problem, we propose a smart water flow monitoring system that constantly checks water usage and identifies if too much water is being used. The core of this system is a NodeMCU (ESP32) microcontroller, which is responsible for collecting data and controlling the system in real-time. The system uses a water flow sensor to measure the rate at which water flows through industrial pipelines. This sensor provides accurate and continuous data on how much water is being used. If the system detects that the water flow rate is higher than a set limit, it sends an alert to notify the appropriate people about the potential overuse of water.

To further prevent water waste, the system includes a solenoid valve. This valve automatically shuts off the water supply when it detects that too much water is flowing, helping to stop waste. The system also has a feature for monitoring water quality, ensuring that the water meets the necessary standards for industrial use.
The system is connected to an IoT-based mobile application, which allows users to access real-time data. Users can monitor water usage through the app, receive notifications about any issues, and even control the system remotely. This method not only helps industries use water more efficiently but also supports sustainable water management by reducing waste and ensuring water is supplied effectively. By combining real-time monitoring and Internet of Things (IoT) technology, this system provides a practical and scalable solution for managing industrial water use.

Keywords - Node MCU, Water flow rate, Solenoid valve, Quality check, Theft monitoring.

I. INTRODUCTION

In metropolitan regions with the enormous monetary improvement, the water request of people is furthermore growing. Water is a basic resource for all of the living on the earth. In that a couple of individuals are not getting the satisfactory proportion of water taking into account inconsistent appropriation of water. The individual in control will go to the spot and afterward open the valve to that specific region. This kind of movement needs work supply. Individuals might take overabundant water for their own utilization with the help of motors or some other equipment. The water wastage is a direct result of various reasons, for example, we are using drinking water for planting and water spillages are not checked precisely. There is an unexpected issue of irregularity of water supply. In order to complete the proposed water supply system, the microcontroller regulator is related with the flow sensor and solenoid valve, and afterward to the relay circuit. At whatever point the water stream surpasses the relay circuit will be closed and the supply to the valve will be cut-off. If excess water is detected, a penalty will be charged according to the flow rate calculated and it will be updated in the application.

II. RELATED WORK

A. Water Leakage and Theft Detection Using IoT: In 2021, Sunilkumar Hattaraki and Achyut Siddanna Yaragal created an IoT-based system that focuses on detecting water leaks and theft. Their system utilizes a NodeMCU microcontroller to measure water flow. The data collected is then sent to a mobile application called Blynk, which allows users to monitor their water usage easily. If a leak is detected, the system immediately alerts the user, and it can even adjust the water flow automatically to prevent wastage. This constant monitoring helps manage water use effectively and ensures that it is utilized properly across different settings. This simple and user-friendly system can be implemented in homes, businesses, and communities to enhance water management.

B. Smart Urban Water Supply Scheme with Water Theft Detection System: Grande Chaitanya and his team developed a smart water distribution system that uses Arduino technology to detect water theft. This system employs flow sensors to monitor the water distribution network and identify any theft or unusual usage. When the system detects a problem, it promptly alerts the authorities, enabling them to take quick action to resolve the issue. This is particularly important in urban areas, where water theft can lead to significant financial losses and resource depletion. By automating the detection of theft and irregularities, this system ensures that water is distributed fairly, helping to conserve valuable resources and maintain a steady water supply for all residents.

C. Design & Implementation of Intelligent Water Supply Management System Based on PLC & SCADA: Suraj Bambal and his team explored advanced technologies like PLC (Programmable Logic Controller) and SCADA (Supervisory Control and Data Acquisition) to create an intelligent water management system. They integrated various sensors and solenoid valves into their system to monitor and control water flow automatically. Although this system is highly effective in managing large-scale water supplies, it can be complex and challenging to implement, particularly for smaller organizations or communities. However, the benefits of automation in detecting leaks and monitoring pump operations make it an invaluable tool for industrial water management. The system's ability to gather data and control water flow contributes significantly to improving overall water resource management.

D. Public Water Supply Monitoring to Avoid Tampering and Waterman Fraud Using Smart Water Meter System: Anil Gantala and his colleagues designed a smart water meter system aimed at preventing tampering with public water supplies. By employing smart meters and solenoid valves, their system regulates the amount of water each consumer can access. This approach not only conserves water but also prevents fraudulent activities by automatically managing the water supply. It is particularly beneficial for municipal water authorities that strive to eliminate misuse of public resources. By reducing the need for manual monitoring, this system saves time and labor costs while enhancing overall efficiency in water management.

E. Automated Drinking Water Supply System and Theft Identification Using Embedded Technology: Sagar Khole and his team created an embedded system to monitor drinking water supplies and detect theft. This system employs flow sensors to keep track of water flow. If any theft is identified, a GSM module sends an alert to the relevant authorities to take action. Additionally, the system can automatically shut off the water supply using a solenoid valve to prevent unauthorized use. This real-time monitoring capability helps water suppliers respond quickly to any issues, ensuring that only authorized individuals have access to the water supply. The system not only helps protect water resources but also promotes responsible usage among consumers.

F. Public Water Supply Grid Monitoring to Avoid Tampering and Waterman Fraud Using IoT: In 2020, Nirosha S.V. and her team developed a system using IoT technology to monitor water distribution grids. This system includes sensors that detect water flow in pipelines, ensuring that every consumer receives their fair share of water. By identifying tampering and preventing fraud, the system guarantees that water is distributed equitably. This is especially vital in regions facing water scarcity, as it helps reduce waste and optimizes the use of available resources. With its ability to provide timely data and alerts, this IoT-based system contributes significantly to effective water management and sustainability in public water supply networks.

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III. METHODOLOGY

Existing Method:

In the existing system, urban water is supplied to the home with the help of some man power. The individual in control will go to the spot and afterward open the valve to that specific region. The theft can be prevented only when any public informs the officials about the theft. The current examination drives depend upon hardware to deduct the event of piped water burglary. These works have fundamentally utilized flow rate sensor information gathered from water distribution and fed into the microcontroller memory to find the condition of the network in light of hardcoded rules. In this survey, we have settled the issue by incorporating equipment and programming ways to deal with wisely predicted burglary. The data assembled over stretches gives a fair representation of the real- life situation of funneled water appropriation.

Proposed Method:

Our proposed system is commissioned with a flow sensor and solenoid valve for every house supported by an Arduino microcontroller. Water flow time is fixed so we can get supply at the right time. Water flow equipment is confined to each house. A solenoid valve is used to cut the water in case of high or low flow. At that time, intimation will be given to the head office and updated in the app. Flow rate and the amount per liter will be calculated and updated. If excess water is detected, a penalty amount will be charged. Users can pay their bill using this app.

A. NodeMCU (ESP32)

NodeMCU is a minimal expense open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and equipment which depended on the ESP-12 module. Later, support for the ESP32 32-bit MCU was added.

B. Flow Sensor

Water flow sensors are introduced at the water source or lines to quantify the stream of water flow and calculate how much water moved through the line. Rate of stream of water is estimated as liters per hour or cubic meters

C. Solenoid Valve

A solenoid valve is an electrically controlled valve. Profoundly plunger (ferromagnetic core) in its middle. In the rest position, the plunger closes off a small orifice. An electric flow through the loop makes a magnetic field. The magnetic field applies an upwards force on the plunger opening the hole. This is the essential rule that is used to open and close solenoid valves.

D. Relay

Relays are the switches which target closing and opening the circuits electronically as well as electromechanically. It controls the opening and closing of the circuit contacts of an electronic circuit.

E. TDS Sensor

A high TDS level means you have an abundance of dissolved solids in your water, which typically includes minerals. Over time, the constant presence of these minerals in your water can lead to scale buildup in your pipes and appliances which shortens their lifespan and effectiveness.

F. Application

Our application is developed using Flutter. Stream rate information from water appropriation organizations can be gathered for a reasonable period of time and be utilized to demonstrate and predict water theft using our model. As a drive to destroy piped water robbery issue, a complete framework can be additionally evolved.

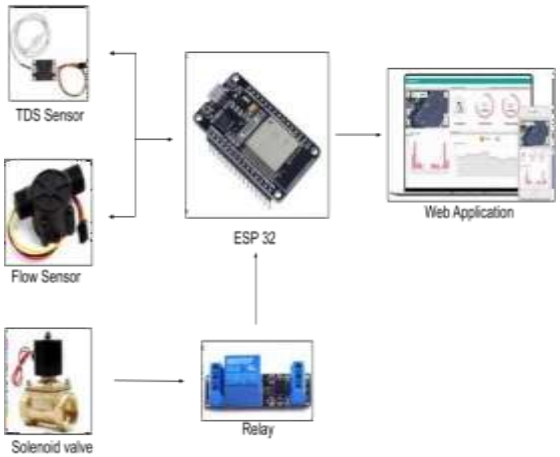

Fig. 1 Block Diagram

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Fig. 2 Flow chart

IV. RESULT AND DISCUSSION

- A feed for every parameter is planned on firebase cloud application. As the framework gets everything rolling the upward tank is filled by its level of water. The water is provided by these valves which work naturally based on the stream rate given by stream sensors in l/min.
- Assuming the water supply of any line should be halted, it very well may be controlled from firebase cloud application(flutter) through portable by making hand-off ON/OFF. In this way, it is feasible to control the solenoid valve. For a vacant pipeline in any circumstance, the solenoid valve will be closed all of the time.
- So, there will be no stagnation of water or spillage through pipes. The water appropriation is accomplished by legitimate booking by keeping a time span at Water application. On the server the past records can be noticed and the information is consistently pushed on cloud for constant observing and controlling.

V. CONCLUSION

Subsequently, a water supply checking and theft detection framework was built. Using the proposed framework, we can incorporate a water control and burglary detection framework. We can guarantee fair water supply to all clients by preventing water robbery and guaranteeing by making a fundamental move. The hindrance of the current framework that required manpower was eliminated. This constant mechanization executed in the system avoids wastage of water and lessens time. Due to the information base, checking the entire framework from the focal office and producing day to day, month to month and yearly reports is conceivable, for quantitative examination of supply water.

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