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IOT BASED SMART WATER MANAGEMENT, MONITORING AND DISTRIBUTION SYSTEM FOR AN APARTMENT

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ABSTRACT

As we know water is so precious for human being as well as for the complete nature without which it will not be possible to survive. Even though lot many efforts have been taken by government through various schemes and it is becoming difficult day by day to save water for future and make efficient utilization of it. Here the main focus is on water utilization in big apartments and save water with proper distribution and monitoring system. The intension of this work is water management, monitoring and proper distribution of water to save water and make efficient use of it, so that we can satisfy the trust of others. The system has been designed in such a way that it will monitor the available water level continuously. System has been implemented by using embedded system and communication will takes through IoT.

INTRODUCTION

In urban areas water distribution is among those issues which are not taken seriously. There are a lots of issues related to water, among those a small issue is fight among the peoples of apartments for acquiring water as per their requirement. Here this paper will define the system which will supply water in each block in channelized form from first to last user. Embedded system had been implemented using Arduino controller, as one of the easily available option so that complete model will become cost effective [1]. Arduino will regulate the required quantity of water in proper time interval. When the flow rate of water will exceed the predetermined limit a solenoid valve will help in controlling the flow. Water supply has been done for defined duration with required speed of flow, by controlling solenoid valve turning on and off. Billing will be done as per the water utilized. If you are saving water it means saving money. One more possibility we had considered is that more requirement of water occasionally. In such cases it is

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possible to put the message for more water requirement, based on the available water storage it will decided that how much water you are going to get. System will continuously update about the water utilized and available storage at central place. All the details will be updated on cloud through IoT. User can communicate through the mobile application implemented for demand, monitoring and billing system.

Literature survey

Ting Wang, Jian Zhong Hao, Li Zhuo, Qing Zhang and Yan Wei, "A management information system— Independent water account management system," 2011 2nd International Conference on Artificial Intelligence, Management Science and Electronic Commerce (AIMSEC), Dengleng, 2011, pp. 6916- 6919.

As we know water is so precious for human being as well as for the complete nature without which it will not be possible to survive. Now a day we many complain and so many activities are going on to increase the awareness among the people for saving water and efficient utilization of it. Even though lot many efforts have been taken by government through various schemes it is becoming difficult day by day to save water for future and make efficient utilization of it. Here the main focus is on water utilization in big apartments and save water with proper distribution and monitoring system. There are two major factors for water wastage or non-efficient utilization of water in big apartment of urban areas, first point is water is available without much efforts and second point is no control on utilization of it. The intension of this work is water management, monitoring and proper distribution of water to save water and make efficient use of it so that we can satisfy the trust of others. The system has been designed in such a way that it will monitor the available water level continuously. Distribute the water in each block as per the demand or requirement and send the bill on developed application as per water utilization. System had been implemented using embedded system and communication will take through IoT. In urban areas water distribution is among those issues which are not taken seriously. There are a lots of issues related to water, among those a small issue is fight among the peoples of apartments for acquiring water as per their requirement. Here this paper will define the system which will supply water in each block in channelized form from first to last user. Embedded system had been implemented using Arduino controller, as one of the easily available option so that complete model will become cost effective [1]. Arduino will

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L. Zhenhua, "Supervision and Management Information System for Rural Drinking Water Project Construction," 2013 Third International Conference on Intelligent System Design and Engineering Applications, Hong Kong, 2013, pp. 1372-1375.

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die of water pollution related illness every day. In many developing countries, dirty or contaminated water is being used for drinking without any proper former treatment. The main reason for this happening is the unawareness among public and administration and the lack of water quality monitoring system which creates serious health related issues. Also, natural phenomena also change the quality of water and results into contamination of water. The most important aspect for all living organisms is water and it is necessary to preserve water. So, water quality monitoring is fundamental step for protection of water resources. Designing this system will help to monitor the quality of water based on information sensed by the sensors submerged in water tank in order to know the various parameters of water. Using different sensors, this system can collect various parameters from water, such as temperature, water level, water flow. Problem Statement: • Water quality monitoring in real time faces challenges because of global warming limited water resources, growing population, etc. • Modern water supply systems (WSSs) are complex and challenging to maintain due to improved urbanization level sand consumer demand uncertainties. • In urban areas water distribution is among those issues which are not taken seriously. There are a lot of issues related to water, among those a small issue is fight among the peoples of apartments for acquiring water as per their requirement.

M. M. Srihari, "Intelligent Water Distribution and Management System Using Internet of Things," 2018 International Conference on Inventive Research in Computing Applications (ICIRCA), Coimbatore, 2018, pp. 785-789.

The objective of this work is to explore the implementation of a low-cost real-time monitoring and control of water consumption together with a user feedback interface. Water usage information will be available in a cloud storage and can be accessed through a mobile application. The collected data allows access and supervision of both client- and water concessionaire. Project feasibility is analyzed in terms of hardware and software, as well as each element required for the design. The simulations were carried out with the purpose of verifying system operation, considering the following metrics: transmission rate, signal strength and transmission quality. After the simulations, the hardware and software were integrated, and the final result was presented through a mobile application. This work presents and

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applies a design and development methodology of Wireless Sensor Network (WSN) using Internet of Things (IoT) technologies and Smart City in water-distribution systems. The water supply in Brazil is a recurring and worrying theme not only in the dry season but also during the whole year in certain regions. Due to the deficiency of the last years and to the decrease of the water level in the dams, the water supply has become a serious problem. To make matters worse, water loss is very high. According to the SNIS (2019), in 2016 the state of Minas Gerais lost 34.47% of revenue due to water loss, leaks, robberies, clandestine connections and measurement errors. In Brazil, this average total value was 36.24%, which represents a loss of over R$ 8 billion. For instance, the northern area of Minas Gerais, in the city of Montes Claros, Brazil, was forced to endure several periods of shortage, some of them interrupting water distribution for two days (COPASA, 2019), causing several hardships to city residents. According to a United Nations report (UNESCO, 2015) and Christofidis (2003), if current water supply and distribution conditions are maintained, 70% of the planet's inhabitants will face deficiencies in water supply, and a quarter of the population suffer chronic shortages of drinking water. The shortage of natural resources is a constant concern of environmentalists, government, institutions and companies who also wish to reduce expenses, in addition to the environmental factor. For this reason, programs to reduce losses and raise awareness about the use of natural resources are a constant theme in the country's affairs. Silva et al. (2016) presented a study to describe the technologies developed by Embrapa, a public agricultural research institution, for the rational use of water in irrigation systems of Brazil. The majority of them are related to knowledge and techniques, such as personal training, construction of small dams, collecting rainwater, etc. Some technologies featured in the work of Silva et al. (2016) use software to check the crops and farms, but the use of new IoT and Smart City concepts are not largely applied yet. The use of IoT technologies brings new possibilities to measure and predict water consumption and to store data about how water is being used. These data can help water concessionaires foresee problems such as leakages or robberies faster, and thereby avoid losses. This large amount of information will be stored in the cloud, so it can be used as input for statistical studies or in machine-learning applications. Further, online feedback information would help to

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establish better practices. The work of Tom et al. (2011) illustrates how important it is to have real-time consumption information with easy access for residents. This research reports that households that received data loggers feedback from daily consumption had a significant improvement in reducing consumption compared with those who received weekly advice from a professional at home. Based on these findings, this work proposes the use of the Wireless Sensor Networks (WSN), Smart City and IoT concepts to perform individual monitoring with online feedback and control of water consumption in residences through an Android mobile application, with excessive-expense or leak-warning tools. A recent report in Saravanan et al. (2018) has illustrated a SCADA system to measure water flow, temperature and turbidity. The data is sent to a web server that performs analytics to show water conditions to the user but, in this case, using GSM technology may not be the best choice due to the high operational cost and power consumption. Riis (2016) also proposed the installation of the SCADA software with PLC and Fieldbus/Ethernet communication in control points of the water company supply; but despite being a robust option, it is expensive and the solution does not include domestic water monitoring. Gupta et al. (2018) proposed a water-quality monitoring system using Raspberry Pi module with integrated WiFi network, which depends on WiFi signal to send information to the cloud. Other similar researches in several applications are proposed by Kim et al. (2008), Larson et al. (2012), Anjana et al. (2015), Wadekar et al. (2016), Rasin and Abdullah (2017), Rajurkar et al. (2017), Suresh et al. (2017), Srihari (2018), Zhang et al. (2019), Zin et al. (2019). This paper proposes the new IoT solution for domestic water-consumption monitoring with the use of the Zigbee technology. This system was developed to operate in low-cost and low-power conditions to build large WSNs, through mesh network, capable of sending data to the cloud and providing the user the possibility of having online information through a mobile app. Water consumption will be on display, and the user can take action when necessary. Although the only parameter measured is the water flow, for power consumption optimization, the system can easily be modified to accept many others; when the microcontroller can handle it, the software need only be updated to receive the new parameters. The “Materials and Methods” section of the paper shows the hardware and software design. The “Results and Discussion” section presents prototype

testing. Finally, the "Conclusion" section concludes the study.

V. Radhakrishnan and W. Wu, "IoT Technology for Smart Water System," 2018 IEEE 20th International Conference on High Performance Computing and Communications; IEEE 16th International Conference on Smart City; IEEE 4th International Conference on Data Science and Systems (HPCC/SmartCity/DSS), Exeter, United Kingdom, 2018, pp. 1491-1496

A serious drop in ensuring the water quality in the distribution system is a factor that affects public health. This could lead to increase in biological and non-biological contents, change in colour and odour of the water. These contaminants cause a serious threat to the whole water ecosystem. The conventional methods of analyzing the water quality require much time and labour. So there is a need to monitor and protect the water with a real time water quality monitoring system in order to make active measurements to reduce contamination. The growth of the technology had helped in developing efficient methods to solve many serious issues in real-time. Internet of things (IoT) has achieved a great focus due to its faster processing and intelligence. This paper focuses on discussing the architecture, applications and need of IoT in water management system. Intelligent monitoring is defined as a method which is used to monitor, control, manage and optimize the network by using different computational methods that will provide customers with relevant tools and information [1]. The internet of things (IoT) forms an important part of intelligent monitoring which connects people and devices using wireless sensor technology. It is a fast growing research area in the military, energy management, healthcare and many more. The concept of IoT was proposed by Kevin Ashton to demonstrate a set of interconnected devices [1]. IoT makes it possible to transfer information between different electronic devices embedded with new technology. The energy management is possible using energy harvesting mechanisms, which is a method of collecting energy from natural sources such as light, vibration, pressure etc. The combination of technologies such as Wireless sensor network (WSN), Radio frequency identification (RFID), Energy harvesting(EH) and Artificial Intelligence (AI) helps IoT to flourish widely. Water distribution system(WDS) is a very important research area that affects the economic

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growth of our country. WDS mainly have two issues, first is the water loss due to leakage and the second is that it is prone to contamination. It is affecting the health and safety of the people. According to the report of world health organization (WHO) in 2017, around 2.1 billion people around the world lack safe drinking water. So there is a need to ensure the water quality and wastage by using Iot to reduce such issue. There are different traditional methods to collect water datasets to measure its quality, but managing and monitoring the data from WDS in real time is challenging as the data is heterogeneous, data collection is time-consuming, energy required for processing, coverage and connectivity of the nodes in the network. By using IoT and combining technologies such as WSN, AI and EH can be used to ensure the water quality in real time and alerts the users to take remedial measures. In this survey, we look at the need of IoT in smart water system. In the first step, a basic architecture is selected and applied in WDS by analysing and comparing different technologies, equipment, cost and methods to build a smart water system. It reveals the need for an IoT architecture with technologies combined for water distribution system. It also takes into account of its advantages and disadvantages based on the literature review. The selection of the best choice can be identified for smart water system at the end of this step. The next step involves selection of the parameters required using IoT for water distribution. At this step, the current issues during the selection of parameters and some suitable suggestions are provided. Finally, an overview of the benefits which is necessary to implement IoT in smart water system is discussed.

C. J. T. Dinio et al., "Automated Water Source Scheduling System with Flow Control System," 2018 IEEE 10th International Conference on Humanoid, Nanotechnology, Information Technology,Communication and Control, Environment and Management (HNICEM), Baguio City, Philippines, 2018, pp. 1-5.

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Existing system

Various IoT (Internet of Things) based smart water management systems have been implemented globally, particularly in residential and commercial settings. These systems aim to enhance water efficiency, monitor consumption, and automate distribution. An existing system designed for an apartment typically involves the integration of IoT sensors, smart meters, and a centralized management platform. Smart water meters installed at individual units within the apartment complex enable real-time monitoring of water consumption. These meters are often equipped with IoT capabilities to transmit data wirelessly to a centralized server or cloud-based platform. Residents and building managers can access this platform through a user-friendly interface to track their water usage, receive alerts for potential leaks, and set consumption goals. Automated valves and controllers can be integrated into the plumbing system, allowing for remote control and optimization of water distribution. Leak detection algorithms and analytics contribute to early identification of potential issues, preventing water wastage and minimizing damage. The adoption of such IoT-based smart water management systems not only promotes water conservation but also provides valuable insights for efficient resource utilization. It's important to note that developments in this field may have occurred since my last update, so checking for the latest technologies and implementations is advisable.

IMPLEMENTATION

BLOCK DIAGRAM

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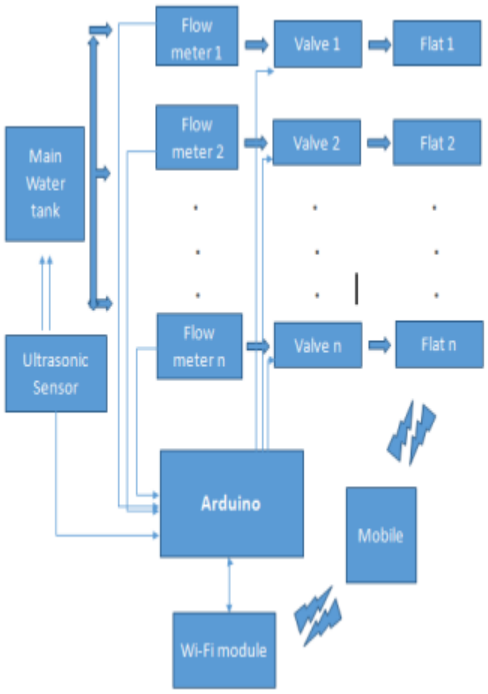

A proposed IoT-based smart water management, monitoring, and distribution system for an apartment envisions a comprehensive solution to optimize water usage, enhance efficiency, and reduce wastage. In this system, each apartment unit would be equipped with smart water meters featuring IoT capabilities for real-time data transmission. These meters would communicate with a centralized IoT platform, hosted either locally or on the cloud, where residents and building administrators can access a user-friendly interface to monitor individual and collective water consumption. The system would also incorporate intelligent leak detection algorithms to identify potential issues promptly. Automated valves and controllers would allow remote control and management of water distribution, enabling adjustments based on usage patterns and demand. Integration with mobile applications would empower residents to set consumption goals, receive real-time alerts, and actively participate in water conservation efforts. The proposed system aims to provide a holistic and data-driven approach to water management within the apartment complex, ensuring sustainability, cost-effectiveness, and the reduction of environmental impact. As technology evolves, continuous updates and improvements could be implemented to enhance the system's capabilities and further contribute to efficient water resource utilization in residential settings.

CONCLUSION

The system has been implemented successfully. The proposed system is a completely automatic system that can perform three different tasks in one unit monitoring, distribution and billing. Water wastage is fully controlled by providing the billing system for their respected water utilization. It is also a cost effective system, where the user can also save water and money. Time to time alert has been given on the water utilization. This project will satisfy

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the significant need of this generation to save our future generations from water scarcity.

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