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IoT Based Smart Water Monitoring & Distribution System For An Apartments

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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. In this proposed work, an IoT design for water monitoring and control approach which supports internet-based data collection on real time bases.

This proposed system shall implement in highly populated residential buildings like hotels, lodge, hostels, dormitory, apartments, shopping malls etc. And also, this system can provide a complete survey and the usage of water by every individual room. This system addresses that the flow rate measuring and scheming the supply of water in order to limit the water wastage and approach the water conservation and also this system can measure the quality and quantity of water distributed to every household by using ph and flow rate sensors. 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.

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INTRODUCTION

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. 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 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.

LITERATURE REVIEW:

While over 15 million American households rely upon private well sources for water [3], the remaining 110 million households are connected to public water supplies. Likewise, most commercial and industrial applications use public water supplies. Public and municipal water utilities must carefully monitor the water they provide for public safety, billing, and resource management. Over the last few decades, water utility companies have begun installing automated meter reading (AMR) systems to further simplify the process of meter reading, decrease manual labor, and reduce transcription errors within collected data [4]. These systems allow more frequent reporting of measured demand at the individual customers, while simultaneously reducing the manual effort of physically looking at each meter to record the volume measured. In 2018, the American Water Works

Association reported 37% of utilities in North America have fully implemented AMR systems, and another 24% are in the process of doing so [5]. Many of the AMR systems support quarter-hourly reads, but battery limitations and data-related costs constrain the data collection to hourly or daily reads. It is from these AMR systems that the data for our proposed algorithm comes. While there is little work in customer water flow clustering, other research explores clustering of energy customer's using smart meter data. Panapakid is et al. [6], [7] implement clustering of electric smart meter data. As opposed to creating models such as our algorithm, their work clusters the daily typical load profiles within a customer's dataset. Representatives of those clusters are used to complete the second stage clustering across the population of all customers. Their work illustrates the complex problem of identifying the optimal number of clusters in a diverse dataset. In contrast to the Panapakid is work, the clustering method presented here does not require a definition of an optimal number of clusters. Bose and Chen [8], [9] track changing cluster populations over time using fuzzy c-means algorithms. Their work focuses upon migratory patterns of cellular phone customers, for the purposes of tracking dynamic market demands and customer retention. Their data exhibit not only customers who migrate from one cluster within the data to another, but also the formation of new clusters and dissolution of others as new behavior patterns emerge within the population.

PROPOSED EXPLANATIONS:

This system addresses that the flow rate measuring and scheming the supply of water in order to limit the water wastage and approach the water conservation and also this system can measure the quality and quantity of water distributed to every household by using ph and flow rate sensors. 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.

Proposed smart management platform (hereinafter referred to as SmartWMP) is considering a supervisory and control both water and energy flows to improve water and energy efficiency offering simultaneously the possibility carrying out transactions directly between utilities and local renewable producers in order to provide a sustainable management of water supply systems. The structure of SmartWMP SmartWMP integrates water and energy nexus usage related information from smart meters, data analysis (profiling, modeling, simulation, and optimization) using AI techniques, DR programme, and services for peer-to-peer (P2P) transactions on basis of smart contracts between the water utilities and local renewable producers (inside micro grids). The integrated modules of software are the following: Integrated Water and Energy Database Management - comprehensive analysis of integrated databases to describe different patterns to the level of pump stations (water and energy) and consumers (water).

Water distribution system (WDS) is a very important research area that affects the economic 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.

DR programme identifies solutions for the water pumps which could participate in a DR scheme and how the control of power consumption improves the potential of participation in a DR scheme. Blockchain based ICT topology analyses the potential impact of Blockchain technology on the integrated water and power sectors and explores what opportunities it may hold for water utilities. A vision of solution is presented.

Integrated Profiling Concept to treat integrated of the profiling techniques to energy and water used in a smart management based on the correlation between data provided by the smart metering system.

AI based techniques for modelling and simulation develop the mathematical models and computing algorithms based on meta-heuristic approaches for optimization and expert systems for decision making in pumping water management.

ARDUINO UNO:

The Arduino Integrated Development Environment (IDE) is a cross platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program argued to convert the executable code into a text file in hexadecimal encoding.

Flow sensor:

Measure liquid/water flow for your solar, water conservation systems, storage tanks, water recycling home applications, irrigation systems and much more. The sensors are solidly constructed and provide a digital pulse each time an amount of water passes through the pipe. The output can easily be connected to a microcontroller for monitoring water usage and calculating the amount of water remaining in a tank etc.

The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino Software (IDE) includes a Wire library to simplify use of the I2C bus; see the documentation for details. For SPI communication, use the SPI library.

Ultrasonic sensor

The ultrasonic sensor works on the principle of SONAR and RADAR system which is used to determine the distance to an object.

Ultrasound

Ultrasound is high-pitched sound waves with frequencies higher than the audible limit of human hearing. Human ears can hear sound waves that vibrate in the range from about

20 times a second (a deep rumbling noise) to about 20,000 times a second (a high-pitched whistling). However, ultrasound has a frequency of over 20,000 Hz and is therefore inaudible to humans.

At its core, the HC-SR04 Ultrasonic distance sensor consists of two ultrasonic transducers. The one acts as a transmitter which converts electrical signal into 40 KHz ultrasonic sound pulses. The receiver listens for the transmitted pulses. If it receives them it produces an output pulse whose width can be used to determine the distance the pulse travelled. As simple as pie! The sensor is small, easy to use in any robotics project and offers excellent non-contact range detection between 2 cm to 400 cm (that's about an inch to 13 feet) with an accuracy of 3mm. Since it operates on 5 volts, it can be hooked directly to an Arduino or any other 5V logic microcontrollers.

PH sensor

PH sensors measure the level of PH in sample solutions by measuring the activity of the hydrogen ions in the solutions. This activity is compared to pure water (a neutral solution) using a pH scale of 0 to 14 to determine the acidity or alkalinity of the sample solutions. Additionally added Light intensity sensor, Temperature sensor and Water Level sensor. This module can measure the amount of water level and temperature range and light intensity.

CONCLUSION:

The implementation of the Smart Water Management system is done in two stages. Second is the pulling the data from database and made available for visualization, alert systems etc. Raspberry Pi is configured so as to function it as a central system. Installed debian Operating system, lamp server for web server and MySQL database. Cron jobs are used for scheduled running of scripts that will generate reports in daily/monthly/year Sensors are deployed in PoUs. Each PoUs contain 4 sensors at different levels. Sensors will give a TRUE if water is there at that level else return FALSE. One Arduino board is deployed for each PoUs. Arduino board is configured to capture the data from sensors and then encode it in the form of #_#. Example of the string is #S105_TTFF# which indicates, it is the data from the sump which has id 105 and have water level above 40% and below 60%. For the ease of calculation there will be 50% water. All PoUs will send the string to the local centralized server from which the processing starts.

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