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An IoT Based Architecture on Real Time Water Leakage Monitoring System

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Abstract: Globally leakages in portable water supply lines amounts to be more than 40% with the costs of ~US$ 100 billion in revenue and has a major impact on economies. This implies that there is a need for systems to be developed to monitor pipeline leakages to avoid the water loss. Frequency signature of the hissing noise created during the water leaks, can be detected by acoustic sensors such as hydrophone to detect the water leak. In this work a hydrophone based IoT wireless sensor node and platform is presented for water pipe line leak detection. Leak detection is achieved by capturing acoustic signatures from an array of active hydrophones placed at regular intervals on the pipelines to pick up acoustic signature. Captured acoustic signatures are sent to the central server through the Wi-Fi network for post processing and leak detection.

As a result, a new automated technique, Internet of Things (IoT) is introduced that can connect the actual physical things to Internet. In this paper an attempt is made to illustrate IoT application through an implementation of water leakage detection and monitoring system. This paper emphasis on how sensor system can monitor, detect and locate the leakages in the pipeline system. This research also aims to develop a small scale prototype for real time water leakage alert system and to validate it through experimentation. An intelligent sensor network system consisting of flow sensors and a set of active sensor network platform is used to monitor and detect the leakage in pipelines. The flow sensors provided in the pipes gather the data related to discharge through pipelines. The data collected by sensors is processed by microcontroller- Arduino Uno. Finally, the processed data is monitored on internet using cloud computing.

Introduction: Water is an essential element for every organism, the needs for providing a good water distribution system is a must. Sometimes, the condition in certain location does not allow us to create a good water distribution system on the ground and the development of constructions causes the current water distribution system to residentials, offices, and industry premises through pipes under the ground. Flow liquid meter sensor is one of the sensors that is used for this monitoring process. This sensor uses Hall Effect sensor inside it to measure the water flow rate and is placed on a pipe that has a diameter equal to the diameter of the sensor. The sensor will retrieve water flow data by analysing rotation count of the wheel. A microcontroller is

required to process this data in order to know how the rate of water flow through. Then the data will be sent by the microcontroller to the end node via internet access. Clean water is a critical requirement in human life. Commonly, water distribution is done through underground pipes, where the water pipeline will become more difficult to control than the one in the open space. This situation will cause a permanent loss if there is a disturbance in the pipeline such as leakage. Leaks in pipes may be caused by several factors, such as the age of the pipeline, improper installation, and the condition of the environment (natural disaster, etc.). Therefore, an efficient solution is required to detect and to locate the damage in underground pipeline system.

This work presents a hydrophone based wireless sensor node and a platform that is designed for the purposes of water pipe line leak detection. The leak detection method is to place active hydrophones (with a built in pre amplifier) at regular intervals on the pipelines to pick up acoustic signature. When a crack on the pipe occurs, leak through the crack generates an acoustic noise that is easily picked up and amplified by the active hydrophones. This then conditioned and sampled to generate digital samples. The digitized samples are fed to the central server through Wi-Fi network using a wireless Real time dual channel sensor data is collected at 8K samples/sec with 16 bits resolution in the wireless sensor node. This data is accumulated into 256 bytes frames before being sent to the central server through Wi-Fi network to optimize the network bandwidth usage. The hydrophone sensor data is streamed to the central server through UDP unicast protocol. There is also a back channel UDP data pipe between central server and wireless sensor node for handshaking, command and control. With the Internet of Things (IoT) paradigm, smart devices like smart showers, water monitoring systems, and swimming pool automated treatment systems can be interconnectedinintegratedsolutions,grantingthebestcooperation and interoperability among them. All the smart actuators on the environment will operated considering the data collected by the sensors allowing smart and autonomous decisions on the fly. Smart water taps can be automatically closed when let mistakenly opened by an user, as well as the whole water distribution system will be turned off in case of any leakage, resulting in the reduction of the related expenses and also preventing dangerous situations.

To implement this program, we can develop a smart city concept and costs are reduced. The purpose of this paper is to develop an intelligent and intelligent system, which can make real-time monitoring of leaks in the pipes real-time. This program reduces traffic congestion in a smart city to clean up the environment. To implement this program, we can develop a smart city concept and costs are reduced. To protect the economic and social prosperity of India, it is very important that sufficient resources are available to meet the needs of agriculture, industry, and the domestic sector in the years to come. This situation is the result of the environment and human activity. Due to the unknown pressure of the water flowing through the pipe, there is a risk of damage to the pipe and the leakage of the damage section, as it spreads to consumers. Distributors are not easily identified if there are leaks in the resources while delivering.

Keywords: smart cities; reflex; smart water management; declarative process; Internet of Things; complex event processing; water supply systems; REFlex Water

Review: Global leakage on portable water supply lines exceeds 40% at a cost of ~ US $ 100 billion in revenue and has a significant economic impact. This means that there is a need to develop leaky pipeline monitoring systems to prevent water loss. The typical signature of the attractive sound made during a water leak, can be detected by acoustic sensors such as a hydrophone to detect water leaks. In this project a hydrophone based IoT wireless sensor node and a leaky pipeline detection platform was introduced. Leak detection is achieved by recording acoustic signatures from a large number of active hydrophones that are periodically placed in the pipes to take the acoustic signature. Captured acoustic signatures are sent to a central server via a Wi-Fi network for post processing and leak detection.

Water is one of the most important resources used in the world. Most people around the world do not have access to clean water that can be used, as only 3% of available clean water can be used. Urban migration and industrial development are the main reasons for the water shortage. Apart from urbanization and industrialization, leaks in water supply pipes are a major problem of water shortages if they are not available in the first place. Leaks can cause serious damage to building structures and also lead to significant loss of water that can be used when supplied by water pipes. In recent years, a number of studies have been conducted to improve advanced water management technology. As a result, a new automated process was introduced, the Internet of Things (IoT) that could connect virtual objects to the Internet. In this paper an attempt is made to demonstrate the use of IoT through a leak detection system and monitoring. This paper emphasis is on how the sensor system can monitor, detect and detect leaks in the plumbing system. This study also aims to develop a limited type of real-time water leak awareness system and verify it through testing. A smart sensor network system consisting of flow sensors and a collection of an active sensor network platform is used to monitor and detect pipe leaks. The flow sensors provided in the pipes collect information related to the discharge of the pipes. Data collected by sensors is processed by a microcontroller- Arduino Uno. Finally, the data used is viewed online using cloud computing.

IoT-based Water Monitoring System for Smart Buildings. Water is an important natural resource for sustaining life. Leaks and misuse of this precious resource contribute to water shortages in many parts of the world. Remote monitoring of water use and leak detection, warning users and allowing disruption of water supply can play a significant role in reducing costs and preventing the destruction of this valuable natural resource. The Internet of Things (IoT) paradigm can make a significant contribution to this goal. Subsequently, the paper proposes the development, construction, and validation of a smart system for remote monitoring of water use, leakage and disruption to water distribution. It is characterized by intelligent architecture and can easily be used in other related areas. The proposed solution follows an IoT-based approach and can be easily integrated into an intelligent IoT solution. It has been tested, demonstrated, validated, and ready for use .

Water supply is usually provided by underground pipes. Monitoring groundwater pipes is much more difficult than monitoring groundwater pipes in the open. This condition will cause permanent loss if there is a leak in the pipe such as a leak. Pipe leaks can be caused by a number of factors, such as the age of the pipe, improper installation, and natural disasters. Therefore, a solution is needed to find and locate the damaged area where the

leak is. The leak location detector will use liquid equipment and kinematics physics based on flow water measurement data obtained using a liquid flow sensor and Arduino UNO as a microcontroller. The results show that the proposed method is effective in detecting a two-meter leak, and is able to determine the leak as close as possible with a flow rate of approximately 10 liters per minute [4].

Water is a vital resource for each individual and its existence. Nowadays, the population of cities is increasing rapidly, thanks to a certain number of people moving from rural to urban areas. To meet the demand for water, its distribution and quality testing, a new IoT (Internet of Things) approach is proposed. The proposed system has various sensors such as flow sensor, pH sensor, water control valve and microcontroller. The water control valve is controlled using a web interface based on the amount of water flow sensor to ensure an equilibrium water supply for each connection (end point) The pH sensor is used to measure water quality. A pressure sensor is used to measure the flow of water and the leakage of a pipe leak is also measured. Water distribution and piped water management can be controlled in this paper [5].

Proposed Research Methodology:

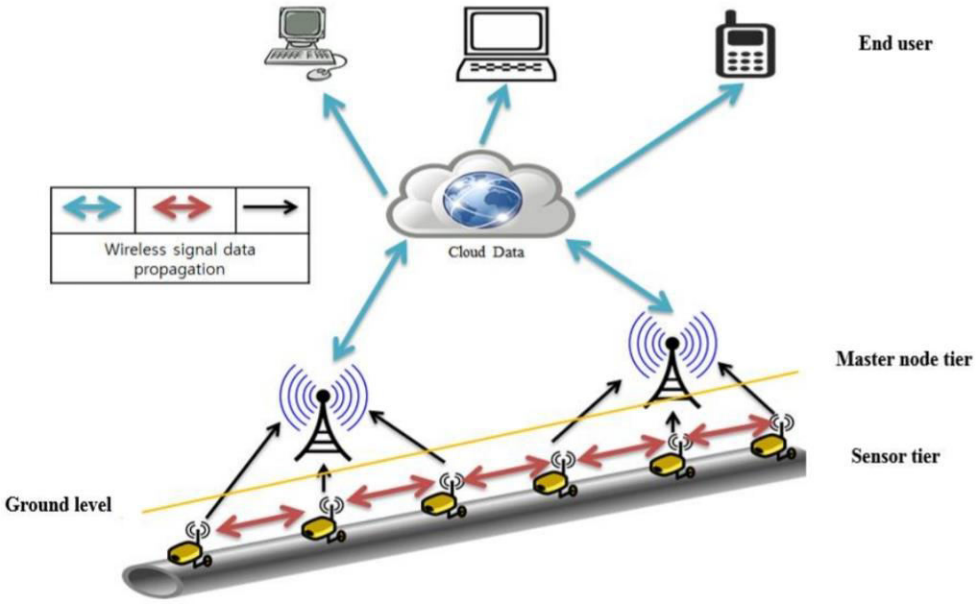

Figure 01: Proposed system

The system mainly consists of sensors of water flow and the provision of hydraulic power supply. The IoT integrated water leak monitoring system is designed to save a single drop of water, which is wasted by leaking pipes in the building. The data used in this study are the level of flow from the sensors provided in the entry and sales phase. Two water flow sensors are used to detect the flow rate. Each water flow sensor is connected to individual pipes. Water pressure sensors will provide water pressure data to the IoT module (Node MCU). On the other hand, the user is connected to the cloud via an MQTT broker .This data is sent to the Node MCU with the ESP8266 Wi-Fi module. So that an authorized person can send a garbage truck only when the dustbin is

full. This reduces the total cost of the garbage truck trip and thus reduces the operating costs associated with garbage collection.

Expected Outcome: In this project, a model water monitoring system is introduced using IoT. In this case, sensors are used. Data will be sent to the cloud server via NodeMCU ESP8266. Data collected from all sensors will be used for analytical purposes to find better solutions to water problems. This application will therefore be a major challenge to the real-time monitoring and control system and is used to solve all water-related problems.

Conclusion:

The development of an intelligent solution for water consumption monitor, detecting leakages, and automatically manage water distribution networks in smart buildings can be crucial to avoid water wasting, which is essential to sustain life and that is scarce to several regions of the planet. Water monitoring mechanisms are not only beneficial for the environment and human health but also to improve the quality of life, as leakage detection can avoid higher water bills as well as health hazards, like mold and other dangerous organisms that develop in water. This paper proposed and validated an IoT-based water monitoring system's principle operation using wireless communication and data publication through MQTT protocol to publish the sensed data in the In.IoT middleware.

This paper presented the architecture and design of a wireless sensor node and an IoT platform that enables to locate the leaks in the portable water pipelines. A detailed description of the sensor node and platform architecture, data transmission method to the central server and GUI program for the data collection is presented. Potential energy conserving techniques described in the power management section can further refined in future to power the entire sensor node from harvested energy such a solar along with a small Li-Po battery. As the sensor node is already designed with powerful ARM MCU that can handle the complex leak detection algorithms, current off line leak detection algorithms will be ported on to the ARM MCU in future for real time pipe line leak detection at the sensor node itself paving a way for edge computing enabling lighter central server. The paper has demonstrated that the combination of these technologies is a powerful tool in the context of water systems management: IoT devices represent an efficient and low-cost solution for continuous monitoring and controlling many aspects of water distribution in real-time; declarative business process languages provide the rigor and flexibility required to specify systems whose behavior is difficult to foresee (e.g., water distribution systems); Complex Event Processing (CEP) technology can handle large data streams produced by the IoT sensors; moreover, CEP languages can express all rules defined in a declarative business process language.

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