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PRE-PAID SMART WATER OVER CLOUD COMPUTING AND WIRELESS SENSOR NETWORK

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ABSTRACT

Water is one of the most vulnerable non-renewable energy which needs immediate from all the sectors of society like an academy, research and from the industry. The deep literature study concludes that 70% of the earth is covered with water bodies that infect the human body made of 75% of water. Water is an integral part of everyone's daily life. Hence these water resources have to be invested wary consciously so that the upcoming generation could survive. The report produced by the World Health Organization (WHO) on India says that the inadequate water management system is a root cause for water scare city though India is well occupied with water bodies. Hence, in this paper, we motivate to propose an efficient water management system (WMS) based on wireless sensor networks and cloud computing. Here, we propose a Prepaid Water Distribution Scheme (PWDS) for the efficient utilization of water resources within the domestic environment. Implementation and validation show promising paradigm towards efficient water utilization.

KEYWORDS: *World Health Organization (WHO), Water Management System (WMS), Prepaid Water Distribution scheme (PWDS)*

1. INTRODUCTION

Water is one of the most valuable non–renewable energy but nowadays water is going to be scary in the world. 70% of the earth is covered with water bodies, in fact, the human body itself is made up of 75% of water. The major percentage of water is salty i.e. 99% and the remaining 1% is available in the form of normal water. This available 1 % of water again fluctuating based on several factors like rainfall, climates changes which affect the water level of various natural reservoirs like pond, river, and lakes. In the process of dealing with this problem, we have proposed a new model called the Pre-paid Water Distribution (PWD) approach which is based on IoT (Internet of Things) and cloud technology. Fig.1 illustrates the various approaches to smart water.

Fig.1 Smart Water Approaches

Advanced technology has become the integral part of our life [1]. To satisfy the need of the society, almost in each work, we use the technology [2] [3]. In current era computer science is major subject [4]. It has many real life applications such as cloud computing [5], artificial intelligence [6], remote monitoring [7], internet of things [8, 9, 10, 11, 12, 13, 14, 15], SPP [16, 17, 18, 19, 20, 21, 22, 23], TP [24, 25, 26], internet

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Security [27], uncertainty [28, 29, 30] and so on. Technology is the mode by which user can store, fetch, communicate and utilize the information [31]. So, all the organizations, industries and also every individual are using computer systems to preserve and share the information. The internet security plays a major role in all computer related applications. The internet security appears in many real-life applications, e.g., home security, banking system, education sector, defense system, Railway, and so on. In this manuscript we discuss about the protection of authentication which is a part of internet security.

The IoT technology helps to setup a network of heterogeneous elements whereas cloud helps to store the end-user data in a centralized pattern. At present we have a smart water meter where it will calculate the usage of water of particular houses/apartment /building, but there is no proper maintenance of data of the user, so there are some disadvantages like cost, wastage of water, sometimes water meter may not work, etc. In the proposed system, we are using prepaid smart water systems on the cloud so that, data of the user will be stored in the cloud, so that it can be accessed anywhere anytime by anybody, and also there will be proper maintenance of data /information. These data can be used for saving water through proper water management because of every water drop matters. The following benefits that can be expected from the proposed system are: Effective utilization of water, Precise consumer information for billing and other managerial tasks, No wastage of water through proper conservation

Water is one of the basic needs required by everyone, water is an essential nutrient for the human body, animals and also plants, etc. We can survive up to several weeks without food but we can't survive without water so water plays an important role. Most of the living organisms depend on surviving, break down food, respiration process, regulate metabolism and dissolves compounds going into or out of the body. The water is also used in a domestic environment for many purposes like; water for drinking, bathing, cleaning cloths, food preparation, gardening, agriculture, and etc. The other outdoor uses are agriculture, industry, petroleum refineries, etc. In all these scenarios water resource is one of the most vulnerable energy. For Instance, if the agriculture field already

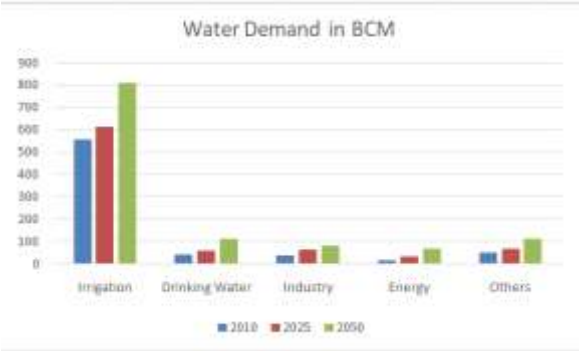

Fig 2: Statistical representation of Table 1

contains moistures then an additional watering process leads to wastage of water. The same way, in the Industrial sector miss management of water resources, may lead to actuate water shortage for other sectors of society. In Table 1, the demands of water by several sectors is presented.

Sector	Water Demand in BCM		
	2010	2025	2050
Irrigation	557	611	807
Drinking Water	43	62	111
Industry	37	67	81
Energy	19	33	70
Others	54	70	111
Total	710	843	1180

Table 1: Water demands by various sector

This subsection explores, the various well knew ongoing water projects all over the world [9]. "The First Resilient Kerala Program Development Policy Operation" (Kerala, India): This program improvises the strength of the state against natural calamities and climate change due to flood. [32] "Ceara Rural Sustainable Development and Competitiveness Phase II" (Brazil): This program improvises access to the markets, access to water & sanitation, and adopting climate-resilient approaches by targeted beneficiaries in selected areas of Ciara [33] "Development Policy Financing with a Catastrophe Deferred Drawdown Option and Pandemic Emergency Financing Facility" (Maldives): This program improvises Maldives economic growth to manage the human physical and fiscal impact of climate changes, natural calamities, and disease outbreaks "Climate Resilience Multi-Phase Programmatic Approach" (Sri Lanka): This program improvises the functioning of the disaster management center (DMC). [34] "Vietnam - Dynamic Cities Integrated Development Project" (Vietnam): This program improvises access to urban infrastructure to

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improve integrated urban planning in the project cities. [35] "Karachi Water and Sewerage Services Improvement Project" (KWSSIP) (Pakistan): This program improvises for water services in Karachi and to enhance KWSB's economic and operational performance. [36] "Water Supply and Sanitation Improvement Project" (Cambodia): This program improvises to piped water supply and improved sanitation / domestic services and strengthens the operational performance of service providers in chosen towns and communes [37] "Modernization of Water Supply and Sanitation Services" (Peru): This program improvises the quality of water and domestic services in chosen areas and improve the Borrower's sectoral institutions and participating service providers' management capacity to provide efficient water and domestic services [38] "Urban Water Supply and Sanitation Project" (Cote d'Ivoire): This program improvises the quality and enhances the water services in chosen areas and strengthen the capacity of ONEP for economic planning and management of urban water supply sector [39] "Rural Water Supply and Sanitation Project" (Tajikistan): This program improvises the basic water supply and domestic services in chosen districts and strengthens the capacity of the institution in the water supply and sanitation sector [40] [41].

Projet Title	country	Project ID	Commitment Amount	Status	Approved Date
The First Resilient Kerala Program Development Policy Operation	India	P169907	250	ACTIVE	June 27 2019
Ceara Rural Sustainable Development and Competitiveness Phase II	Brazil	P167455	100	ACTIVE	July 18 2019
Climate Resilience Multi-Phase Programmatic Approach	SriLanka	P160005	310	ACTIVE	June 25 2019
Vietnam - Dynamic Cities Integrated Development Project	Vietnam	P168290	194.36	ACTIVE	June 11 2019
Karachi Water and Sewerage Services Improvement Project	Pakistan	P164704	40	ACTIVE	June 27 2019
Water Supply and Sanitation Improvement Project	Cambodia	P163876	55	ACTIVE	March 28 2019
Modernization of Water Supply and Sanitation Services	Peru	P157043	70	ACTIVE	July 26 2018
Urban Water Supply and Sanitation Project	Cote d'Ivoire	P170502	150	ACTIVE	June 27 2019
Rural Water Supply and Sanitation Project	Tajikistan	P162637	58	ACTIVE	Feb 28 2019
Development Policy Financing with a Catastrophe Deferred Drawdown Option and Pandemic Emergency Financing Facility	Maldives	P163939	10	AVCTIVE	July 1 2019

Table2: History of ongoing water projects [9]

Motivation: In this current work, we have explored a cloud-based pre-paid smart water management system to efficiently manages the water supply. The presence of cloud technology helps to create a centralized system for efficient data management about water consumption. The proposed pre-paid water scheme to supply a certain amount of water for a particular user based on their requests. Through this, we can reduce the wastage of water. The rest of the paper can be viewed as; Section 2: contains literature review; Section 3: explains proposed work, Section 4: discusses the result and discussion and Section 5: covers conclusion followed by references.

2. LITERATURE REVIEW

In this paper, the author designed water management using IoT so this paper tells about the water level monitor continuously from anywhere using an android application. It is a robust system and small in size. But this application is implemented in bungalow or Industrial level in further added feature can deploy IoT devices in the sea, leak, and river so if any varies in water level the user can get the notification for alerting [42]. In this paper, the author presenting a practical low-cost smart water meter device which is capable of determining possible leakage in the customer's property and reporting current household water consumption levels in real-time in this we can only detect so further added feature is to build any android application so that user can access their data anywhere any time [43]. In this paper, the author implemented a smart water quality monitoring system. This paper deals with checking the quality of water in certain areas based on the temperature relation with ph. The conductivity factor also has been observed for all the water samples using GSM Technology. It is an added feature of incorporating IoT Platform for real-time water monitoring [44]. In this paper, the authors has been deployed an efficient and cost effective method of placing an upper limit on the amount of water used on daily basis. So, incase water level

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raised then user is pre-alarmed and the proposed design in a strategy, which will also help the user to keep a check on the amount of water leaking from the faucet. This work is promoting smart planning for health and sustainable water management [45].

This paper focuses on the interfaces and leakages between formal and informal institutional frameworks for water management. There is a case study on the same can be viewed at Tanzania, Mkoji sub-catchment in the Rufiji Basin [46]. In this paper, the author has presented, the architecture for the smart water distribution system (SWDS) that cooperate with the IoT and Cloud Computing and ICT Technologies. This architecture is designed for intermittent water supply while the previous works is for continuous water supply [47]. In this paper, the author has discussed, some of the key challenges for smart water. In order to, overcome the water shortage problems some steps had been carried out like the development of resources, reduction of higher demands, efficiency in treatment and transmission, etc. [48]. This study has especially donated to the scientific community inside the below-stated areas; Understanding contribution in how we consume water in our homes. A paperback study makes use of real-life information from rental apartments. Indicate that the EDA method is a strong approach when no beforehand secure expectation is held and well suited for this type of Investigative studies. How smart meter data can potentially benefit stakeholders at a building level and improve water management. A good example of an integrated and interdisciplinary approach to tackle composite challenges. Another future research area is the execution of data-driven decision making and management based on smart meter data [49].

In This paper author represents the existing and proposed smart water system and network communication identification, customers who are installed utility meter application based on that amount will be calculated and in this paper researched some of the challenges faced when creating scalable smart water meter networks [50]. In this paper author represents the smart water development and also analysis the current key problems of water information like construction is not proper, data resources need to be integrated, business collaboration and the entire framework of particular area smart water designed and finally this paper represents the architecture of regional smart water by using “Internet of things and also cloud computing [51]. In this paper author represents the novel system for implementing an financial and reliable smart water distributing metering using IoT and smartphone application, the work is being extended to cover a range of distribution metering and lacking for water issues faced by utility centers while providing direct and intangible gains to consumers. And changing the infrastructure of smart water [52].

In this paper, the author represents the architecture and implementation of a smart home irrigation system. The system consists of two sensors motes, special soil humidity sensors, and java application is used for data collection, It also proved that the system is aware of the different watering needs for future work and all the work is managed remotely [53]. In this paper author represents the developments of a small-scale testbed, water box, that simulates smart water networks and also active the evaluation of in-node decision making, energy optimization, automatic control, and event-driven communication algorithms, And also they worked for applying more complex algorithms including new scenarios like security and new sensors such as Water quality [54].In this paper author represents a monitoring system based on user-defined rules for checking resources consumption and co-ordination in community domains, as future work, they decided to design a greater interaction between the monitoring system, home automation control system so that the execution of rules allow actions on the devices such as blocking, putting in low consumption [55]. In this paper, the author represents smart water sensor can developed by ´n Instituto Technologic de Galicia (ITG), for monitoring water quality in remote place infrastructure is made up of hardware unit and web platform it supports sample measurement, local storage, power source, remote control, platform storage, and graphical representation in a web platform. the main advantage of developed station is versatility [56]

3. PROPOSED SYSTEM

The could computing plays an important role in all over the world because it facilitates the user with more benefits like cost reduction by providing some of the services like software as a service, infrastructure as a service, platform as a service, it central remote servers to maintain data and applications and could computing allows consumers and business to use applications without installation and provide storage facilities with security benefits, with low cost and can access anywhere by using the internet so most of the small business as well big one depends on cloud. By using the cloud enables users to get their applications to market easily if in the case of hardware failure does not affect the data, because of network backups cloud computing uses remote

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resources. Saving organizations, the cost of servers and other equipment.

In this paper, the cloud plays an import role because it will store the data of the particular user, information of utility center, and also record the use of water by particular houses so there will be a proper record of each and every user, they can access their data anywhere any time by using the internet and all the areas data will be integrated in the cloud so no need of physical servers required to store the data, it will help the organization with reduction of cost and wastage of water.

Fig 3: Architecture of Proposed System

4. FORMULATION

Input: Sensor Nodes, Base Station, Mobile Sensors

Output: Water Distribution
Step 1: Initialization sensor Nodes with request to the cloud
Step 2: Forward: cloud will forward these to utility center
Step 3: If, Water (Amount_REQ) < (AVL_Quantity)
Step 4: Acknowledgement from Admin
Step 5: Confirmation from User
Step 6: Admin send the request to Utility center to provide particular quantity of water to user
Step 7: Distribute water from utility center to user

5. DEPLOYMENT

For Deployment used Cup carbon software:
Stages of deployment:
Step 1: login to cup carbon-> First save the file in cupcarbon
Step 2: Deploy the sensor in map
Step 3: Deploy 8 server sensor node
Step 4: Deploy 2 mobile sensor
Step 5: Deploy 2 Base station
Step 6: Connect everything in one network
Server sensor node: A sensor node is an object that can detect any digital event (motion event like mobiles), send and receive data. It can be also mobile. The visible parameters of a sensor node are: the radio range, the radio of the sensor unit and the name.

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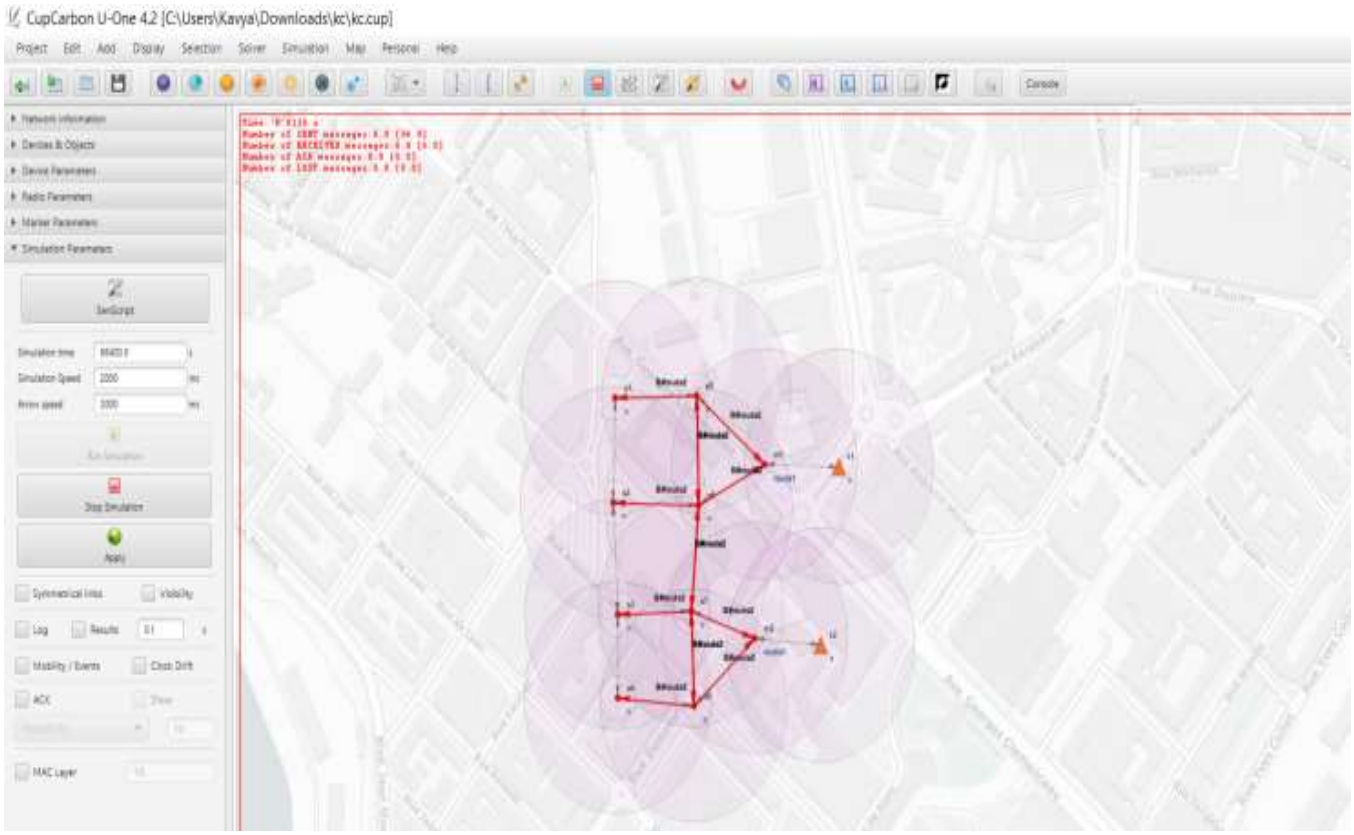

Fig. 5. Sensor Node Deployment

Mobile sensor: Mobile sensor node is used for direction the sensor nodes.
Base station: Base station is used for sinks more sensors in single network
Run Simulation: to start the simulation
Stop Simulation: to stop the simulation
Sen Script Window: to open the Sen Script window and write the script to sensors
Device parameters: Device parameters are used to

6. DISCUSSION

Above Fig 5 describe the deployment of sensor, where Server sensor represents the home/apartments and mobile sensor acts as mediator between houses and utility center to transform the requests from user to admin of utility center. where one base station acts as admin and one base station is utility center, here data is nothing but water and water will be distributed according to user request. The cloud plays an import role because it will store the Information of the particular user, utility center, and also record the use of water by particular houses so there will be a proper record of each and every user, they can access their data anywhere any time by using the internet and all the areas data will be integrated in the cloud.

Fig 6: Work flow in Cloud 1

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Fig 7. Console Management

The simulation results of prepaid smart water over cloud computing and wireless sensor network using different tools the parameters could decrease the wastage of water and maintain the proper data of the user. Proper distribution of water, cost effective, easy to maintain / access.

7. CONCLUSIONS

In this paper, we represented the architecture and implementation of prepaid smart water over cloud computing and wireless sensor network. The sensor consists of three sensor nodes(Server sensor node, Mobile sensor, base station) with the use of cupcarbon software and develops an application using java that is used for conversation between end-user and admin. Performance evaluation showed that our cloud manages the user data and maintain the record of consumption of water and calculate the quantity of water of particular user and also merge the particular area data and integrated with the cloud so utility center can easily manage the data of every user.

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