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Cloud Computing Technology for Efficient Water Resource Management: a Literature Survey

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***Abstract*—**Cloud computing is rapidly becoming an innovative and easy model for delivering the IT services along with dynamic infrastructure. Cloud computing uses Internet as communication media. It also transforming new idea to have centralized application and database servers. Water is a most essential resources and precious gift by nature on earth. It required in all fields viz. Industries, Agriculture, Irrigation, Domestic use, Plantation, Recreation, Wildlife etc. Water is in limited resource and required proper management. The advancement of Information and Communication Technology has significantly adopted for management of water resources. In this literature survey, we studied the work carried-out by the various researchers about the uses of cloud technology for water resource management.

***Keywords*—**Cloud Computing,Water Management, Software, Internet, ICT Infrastructures.

I. INTRODUCTION

With the expansion of the Internet and web based applications using various portable devices leads to have the centralized platform.Cloud technology can be say several servers connected and accessible through Internet to the users for performing a specific computational task. It delivers software, storage service and infrastructure over the Internet and does not require much skill to manage the infrastructure to the users.A cloud environment enables users to run applications by deploying them over a secured web portal to the cloud, which acts like a virtual data centre. The physical cloud resources may reside in a number of locations, the details which are not typically known to the users [1]. The exponential increase of data, advancement of application software, processing and storage devices capacity related to water resource management are also seems essential to have the centralized infrastructure and platform.In this literature survey we tried to study the research work pertaining to cloud technology for water resource management.

II. WHY CLOUD COMPUTING

There are number of benefits to switch over the cloud technology [2]. Some are given as:

Scalability: If there is a huge upswing in computing need or are surprised by a sudden demand, cloud computing can help you manage. Rather than having to buy, install, and configure new equipment, you can buy additional CPU cycles or storage from a third party. Once you have fulfilled your need for additional equipment, you just stop using the cloud provider's services, and you don't have to deal with unneeded equipment. You simply add or subtract based on your organization's need.

Knowledgeable Vendors: Typically, when new technology becomes popular, there are plenty of vendors who pop up to offer their version of that technology. First comers to the cloud computing party are actually very reputable companies. Companies like Amazon, Google, Microsoft, IBM, and Yahoo! have been good vendors because they have offered reliable service, plenty of capacity, and you get some brand familiarity with these well-known names.

More Internal Resources: By shifting your non-mission-critical data needs to a third party, your IT department is freed up to work on important, business-related tasks. No need to have to add more manpower and training that stem from having to deal with these low-level tasks. Also, reduces the burden on service provider. [3]Resources can be allocated and de allocated as per demand in a cloud. This is cost effective since resource can be released when there is less demand.

Security: There are plenty of security risks when using a cloud vendor, but reputable companies strive to keep you safe and secure. There are many security issues that are occurred in cloud computing like data quality, data segregation, data leakage, change management [4].

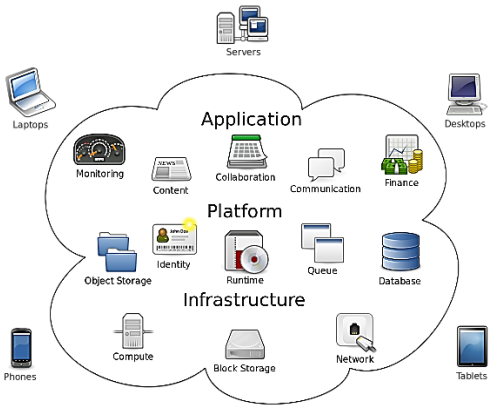

Figure 1. Cloud Computing [5]

III. LITERATURE SURVEY

There are many research studies and related work has been carried-out by researcher and stakeholders for water resource management using cloud technology and proves the need of the technology for better management and policy designing.
SayaliWadekar et al.[6] used cloud technology to store the corresponding water level on cloud and fetched by android application and display to users. IoT latest innovation occurring in wireless technology and embedded technologies, With Microcontrollers working on low powers introduced that are perfect for remotely deployed IoT systems to connect us and work for years without any maintenance has made the IoT not only for luxury functions but also for needful data aggregation as for defence systems.
So in this proposed system they use sensor wires in the overhead tank will detect the level of water. Single stranded wire is used as sensor. Sensing will be done by operating the transistor in switch mode. When a particular water level will be sensed and the corresponding level will be send to the ARM cortex M-4 microcontroller in the CC3200 Launchpad, it will upload the corresponding level of water on the cloud. This data on the cloud will be fetched by the android application and will be displayed to the end user. In this android application recent and previous water levels will be displayed along with date and time. When the water level goes below low level, motor will automatically turn on and when water level goes above high level, motor will turn off automatically.

Z. Y. Wu1 et al. [1] in this paper, they have present a general architecture of HPC cloud computing for high performance optimization of water distribution systems. So they have taken an example of a real water system pump scheduling is demonstrated for HPC cloud application. System supplies about 57 Ml/day with 11 pump stations and 9 tanks. A number of optimization runs have been conducted by using different cores on the HPC cloud. A good performance speedup has been achieved with the HPC cloud for this study. So they have concluded that cloud computing are cost-effective services of various computing tasks. This paper demonstrates that high performance computing can be achieved via cloud computing which is used for pump scheduling for a large water system with effective manner.

HamraAfzaal et al.[7] In this paper they have used cloud computing based flood detection and management system (FDMS) using wireless sensor and actor networks (WSANs).In proposed system they have used two types of sensors i.e., water level sensors for measuring water in a river and rainfall sensors for measuring rainfall level. They have developed a cloud computing based algorithm of flood detection and control management using WSANs. Sensors and actors are deployed randomly in connected subnets to monitor water. The sensors detect information and transmit to gateways which further transmit it to the cloud for efficient computation. The stored information in the cloud is under the supervisory control. The cloud after processing transmits information to gateway node to activate actors if required.

Montalvo Arangoa et al.[8] In this paper they have presented an introductory approach of using cloud computing for supporting decision making processes in water distribution system. The presented ideas were based on the use of Windows azure and other Microsoft technologies. This technique is based on the message passing interface. For water distribution system they have used advanced EPANET toolkit which is totally written in C# and using dynamic memory and the object oriented programming paradigm. Contaminant source identification, online calibration of models and anomalies and event detection in water distribution system are some of the applications that can take great advantage of the use of cloud based solutions for decision making.

Paulo Alencaret al.[9] In this paper they have described about ongoing work on the development of a collaborative multi-sectorial cloud-based platform to support the data sharing, integration and processing requirements for watershed analysis and management. This web-based and mobile cloud based platform is designed to be a system that integrates science and watershed management**.** In this system they have used data governance model which needs to rely on a watershed resource information model (WIRM) that represent the lifecycle of watershed-related projects. The web-based and mobile cloud based platform is designed to be an Integrated Science and Watershed Management System (ISWMSTM). A version of the system is three layers and

layers are: (1) Open Data and Other Data Sources; (2) Science and Engineering; and (3) Human Interface. So the system relies on a governance model based on the notion of watershed resource information model, which meets the strong data sharing, integration and processing requirements of these applications.

Mo Xiaocongetet al. [10] The proposed system consists of three key layers: equipment perception layer, information transmission layer and data application layer. In equipment perception layer, Sensor network for monitoring water information is constructed. In information transmission layer, real-time information transmission is achieved. In data application layer, water information are stored, managed, applied and shared on internet by users. The main aim to proposed this system is to provide accurate and comprehensive information using IoT based real time water resource managemnet system.In this system, water resource information acquisition, transmission and remote monitoring data receiving and application are integrated through software and hardware.In the perception layer, a water information sensor network consists of water quality and water volume detection instruments. Typical flow meter, water quality detecting instrument, water level gauge is selected to get water resource information. Communication protocols of instruments are is interpreted by programming. In addition, a programmable RTU is produced by researchers to obtain and transfer automatically the water parameters, such as water level, flow, and water quality. In the application layer, receiving, monitoring data storage, management and application functions are integrated. As the monitoring task is becoming more and more complex and , more data coming from sensors, devices, Web services require more computational ability for processing than before. The efficient technologies and models for processing the data are also required. Cloud computing new technology for data processing and computation in the IIS, and can integrate extensible data processing, information storage, and other distributed resources to make them work together. So this application shows that system can provide real time and reliable water resource information for water resource management.

AndrejaJonoskietal.[11] This article presents further research that is focused on distributing the web application on two separate virtual machines (VM) and upgrading it to a cloud computing application.The system has four web services: 1. for support of water resources modelling (WRM). 2. for user management. 3. for SDI. 4. for water resources optimization.The web service is built from several components like web form, prototype PHP and Ajax code for uploading data into HMak database, application for optimization based on dynamic programming coded in Java, and a web interface for presenting results. The input data is uploaded using the “Time series data” tab web form and the DP application is executed using “Optimization” . The input data are: reservoir storage discretization, and timeseries of reservoir inflow, reservoir demand, reservoir recreation storage target and reservoir flood target with it’s corresponding demands.

George Suciu[12] In this paper they present the approach of the Water-M project which is oriented to create new products and services, propose as a solution the construction of a unified water business model, of which will benefit European water stakeholders. This paper aim to make a review of state of the art of water management systems, which could be used in the Water-M Project.In this paper they have said that the SCADA technologies are used in water industry to support water sustainability problemsissue.The purpose of this paper is to identify the requirements and needs for smart water management systems through a questionnair, and to propose and evaluate an overall architecture of the WATER-M IoT platform.

IV. RESULTS AND DISCUSSION

In this literature survey, we found that cloud computing technology may be very helpful and beneficial for water resource management. Cloud technology can be used for uploading the observed water resource datawhich may be dynamically available to users anywhere, anytime with minimum IT infrastrcutures. High performance computing is also used for water distribution system which results to good performance speedup.In some systems sensors are used to measure the level of rainfall and transmit this data to gateways which further transmit it to the cloud for efficient computation. Some systems used SCADA technologies in water industry to support water sustainability problem issues as well as IOT devices are efficiently used for data collection.The technology that we have discussed here are not only improve the results but also provids the data security. So in this survey we have analysed and understood that the cloud computing can be effectively used for water resource management system which is further used for sharing the resources, collect huge data on single location it will also provides security and data integrity.

V. Conclusion and Future Scope

In this literature review we found that Cloud computing has been changing the way and methodology for IT solutions and infrastructures.Cloud included infrastructure, platforms and applications that are available from cloud providers as online services. Cloudtechnology bind with cloud computing that may improve the result for efficient and proper water resource management. Computing power and specialization in the cloud have increased the computation capacity. The cloud provides ability to collect and analyse data and provides a platform to share customized analysis and evaluation across

massive data sets to improve water use. The future of water management looks promising as we migrate into a secure, flexible and powerful future of computing. Cloud computing is one important technology for us to manage the most precious resource.

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