IJASRM
International Journal of Advanced Scientific Research and Management, Volume 4 Issue 4, April 2019
www.ijasrm.com
ISSN 2455-6378

Integration of Internet of Things on Cloud Computing and Wireless Sensor Network

D. Dhanya, Renu D. S. and J. Benisha Janice

Computer Science & Engineering, Mar Ephraem College of Engineering & Technology
Malankara Hills, Elavuvilai, Marthandam Kanyakumari District, TamilNadu, 629171, India

Abstract

Major revolutions takes place in technology today is the digital technology taking over analog technology and converting into centralized cloud and wireless systems. With the rapid advancements in wireless technology, small devices began to be utilized in almost all parts of various regions in day today life. These small devices are equipped for sensing, computation and communication. This technological invention is widely known as Wireless Sensor Networks (WSNs). This advanced sensor technology is used in various application scenarios such as environment, agriculture and healthcare too. In the modern days, sampling, collecting and analyzing every possible piece of data is a prerequisite in order to improve production efficiency and ensure optimal resource consumption. WSNs can do the above task of collecting data efficiently. Now the challenge is how these versatile devices could be linked to the World Wide Web. The answer to this challenge is "Internet of Things" (IoT). It has the capability of connecting every device to the World Wide Web. Thus huge amount of data collected from various scenarios could be handled by 'Cloud Services'. This paper presents detailed overview of WSNs, followed by a description of cloud computing services and their possible integration with WSNs and IoT.

Keywords—*Wireless Sensor Networks, Cloud Computing, Internet of Things.*

1. Introduction

In recent years, Innovation has created amazing tools and resources, putting every individual's most useful information at their fingertips. The latest addition related to information technology is wireless sensor Technology which has made its mark in different fields by now. Wireless sensor Technology can be used for real-time data collection and instant communication between devices. The number and types of sensors used are contributing to numerous different applications, such as healthcare, military, critical infrastructure monitoring, environment monitoring, manufacturing etc. However, Scalability issue is the problem in WSNs in order to compute vast set of data, memory and communication, to deal large pools of information is limited. Of all the options available in cloud computing, which provides technology with lots of flexibility, scalability and higher computational resources and storage at fraction of cost? With all of these revolutions, technology has also made our lives easier, faster, better. As per market research report Global Forecast for 2018 to 2023 the WSN is forecasted to reach 93.86 Billion [1].The rest of the paper presents as follows: Section II describes Wireless Sensor Networks. Section III describes Supporting WSN with Cloud and Big Data. Section IV presents the Clubbing of WSN and Cloud Computing. Finally, Section V concludes the paper 2. Headings and Footnotes

2. Wireless Sensor Networks

Wireless sensor network (WSN) consist of a group of dedicated sensors with a communications infrastructure for monitoring and recording the surrounding conditions and store the collected data into central location. There are different types of sensors like temperature sensor, acoustic sensor, magnetic field sensor etc [2][3]. The sensor measure and converts physical phenomenon like heat, light, motion, vibration, and sound into electrical signals. These signals are converted into digital format and send through internet gateway and then stored in central location for future mining. The more modern Sensors are bi-directional. The most recent wireless sensing networks can be even set submerged and underground. Fig. 1 has shown the architecture of wireless sensor networks.

IJASRM International Journal of Advanced Scientific Research and Management, Volume 4 Issue 4, April 2019
www.ijasrm.com
ISSN 2455-6378

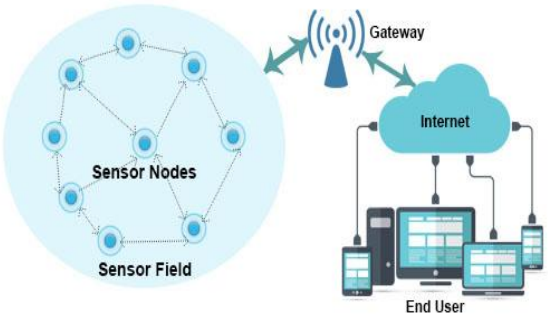


Fig. 1. WSN Architecture

WSN comprise of tiny nodes where each node is connected with sensors. These nodes which can be few or hundreds Nodes communicate with each sensor and broadcast data retrieved from these sensors to centralized systems. The necessity of centralized systems leads to the development of Internet of Things. Fig. 2 has shown the components of a sensor node.

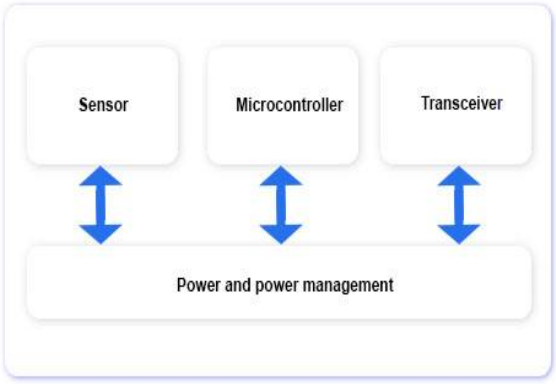


Fig. 2. Components of a sensor node

The sensor node has four modules [4] the power and power management, a sensor, a microcontroller, and a wireless transceiver where each module performs some specific task. First module, the power unit is responsible for providing energy to the sensor node. Second module is the sensing unit of a WSN which can obtain the environmental status and produces the electric signal and then transferring them to the microcontroller. Processing block microcontroller the third module which has memory, microcontroller and operating system, after receiving the data from the sensor, the module is responsible for storing and processing the data accordingly. Fourth module is Wireless Transceiver unit which receives command from the processing unit and passes it to the other node of the network.

3. Supporting WSN with Cloud and Big Data

Cloud computing is a sharing and provisioning of resources on-demand through Internet as and when required at anytime from anywhere.

3.1 Features of cloud computing

1. Service on demand: Users' requests are fulfilled in an automatic manner without any interaction from the cloud-service provider.

2. Resource pooling and elasticity: In cloud computing, resources are shared to serve a large number of users. Cloud computing uses multi-lease where different resources are dynamically allocated and de-allocated according to demand.

3. Usage based cost: Cloud computing does not have any upfront cost. It is completely based on usage. Users are billed based on the amount of resources they use. This helps the users to track their usage and ultimately reduce cost.

4. Quality of Service: Cloud computing must assure the best service level for users. Services outlined in the service level agreements must include guarantees on round-the-clock availability, adequate resources, performance, and bandwidth. Any compromise on these guarantees could prove fatal for customers.

Big Data: Big Data refers to a large volume of data collected, both structured and unstructured. Big Data has three important parts which are volume, variety and velocity [7].Volume refers to the amount of data generated from different sources including business transactions, social networks and information from wireless sensor networks. Variety refers to the different sources and different types of data both structured and unstructured data's. For example structured database, excel, csv, access or the unstructured text documents, video, audio, email etc. Velocity refers to the pace at which data flows. Social media like Facebook has to handle millions of photographs every day, millions of tweets are posted on Twitter. The data flow is enormous and continuous.

Wireless sensor networks collects huge amount of data for a wide variety of application domains, in environment monitoring system environment sensors monitor temperature and humidity values and generate enormous volumes of data. Effective mining [8] of the collected data helps the climate simulators to predict the climate changes

IJASRM
International Journal of Advanced Scientific Research and Management, Volume 4 Issue 4, April 2019
www.ijasrm.com
ISSN 2455-6378

in the atmosphere. However, limited memory, limited energy, limited computation and communication and scalability issues are preventing them from processing the collected data appropriately. Advances in cloud computing and big data allows significant amounts of data to be conveniently structured, stored, navigated, processed, queried and visualized, with extended scalability and flexibility and at low cost. Fig.3 has shown the WSN-Cloud Architecture.

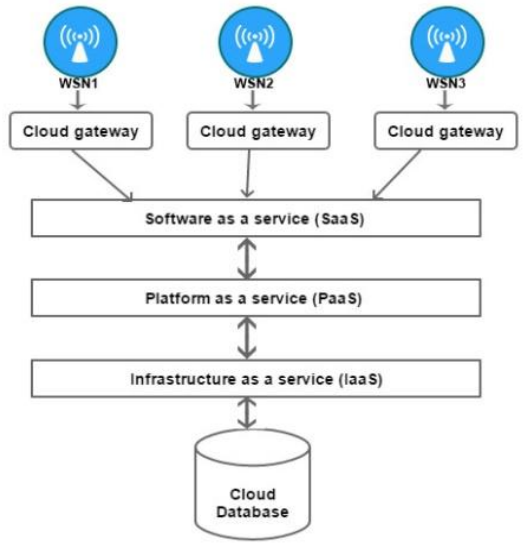


Fig. 3. WSN-Cloud Architecture

Cloud models suitable for WSN are:

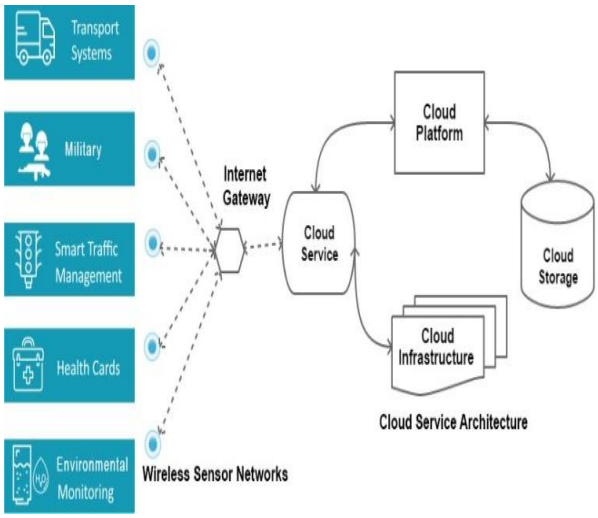
- Infrastructure as a Service (IaaS) is a virtualized computing infrastructure, provisioned and managed over the Internet. The user does not need to buy and manage physical servers and other datacenter infrastructure. Examples are Azure Virtual Machines, Google Compute Engine, Amazon S3, and Amazon EC2.

- Platform as a Service (PaaS) provides development and deployment environment in the cloud. Customers build, test, deploy, manage and update software applications without buying and managing software. Examples are Amazon RDS database server, Google Compute Engine, Amazon Elasticsearch, Microsoft SQL Azure, Heroku.

- Software as a Service (SaaS) provides a complete software solution over the Internet as a service. This avoids complex software and hardware management. SaaS examples are Salesforce, Google Apps, Concur, and Citrix.

4. Clubbing of WSNs and cloud computing

Clubbing WSNs and cloud computing will be a major breakthrough in the field of data analysis. It enables real time sharing and analysis of data on-the-fly. Moreover, sensor data and sensor events could be provided as services over the internet. This allows data to be accessed and analyzed from anywhere in the world. Fig.4 has shown the integration of cloud service and WSNs. The Clubbing of these two technologies could be applied mainly in the following fields:



Transport Monitoring: Sensor data collected and transmitted to the cloud platform could be used in different applications in Transport Monitoring such as traffic control, automatic recognition of plates, toll way management, emergency vehicle notification, dynamic traffic light management etc[9][10]. Cloud platform also allows building a global traffic snapshot updated by users. This data could be used in automatic toll gates, collision avoidance systems etc.

Military: WSNs and cloud computing could be a perfect answer to top level security requirements in the wireless sensor networks used in military. These high level security requirements cannot be provided by normal internet connectivity.

Environmental Monitoring: It is difficult for traditional database approaches to handle the huge data collected by environmental sensors. It, in fact leads to the "big data" issue. But this problem in weather forecasting could be solved by cloud computing.

Health Monitoring: A major use of the successful merging of the two technologies is in the health care field. Today sensor networks are not only used in hospital scenario but also small devices are used by health conscious individuals. Patients and athletes are using portable devices to monitor the condition of their body constantly. Individuals can even get personalized devices according to their life style and health condition.

5. CONCLUSION

Wireless sensor network is a path breaking invention in the field of information technology. The role played by sensors has multiplied in the last few years. Now sensors can be installed in any real time object and are able to collect big data throughout the day. Even though there are certain limitations to be rectified**.** This paper presents the Integration of Internet of Things on cloud computing and WSNs. Interlinking WSNs on cloud computing proposed the possible solution to rectify the limitations of WSNs. Integration of WSN with cloud computing helps end users to control and monitor any real time object through a single easy-to-use interface at anytime from anywhere. Energy content and distribution systems will increase their efficiency and it also helps in applications such as agriculture, Bio medical and other similar sectors too. Therefore it is vital to amalgamate WSNs, IoT with Cloud computing.

References

[1] Wireless Semsor Network Market – Global Forecast to 2023 Wireless Sensor Network Market - Global Forecast to 2023," Markets and Markets,June2018.

[2] J. Yick, B. Mukherjee, and D. Ghosal, “Wireless sensor network survey”, Computer Networks., vol. 52, no. 12, pp. 2292-2330, April. 2008.

[3] A. Flammini and E. Sisinni, “Wireless Sensor Networking in the Internet of Things and Cloud Computing Era”, Procedia Engineering., vol. 87, pp. 672-679, 2014.

[4] M. Kocakulak and I. Butun, “An Overview of Wireless Sensor Networks towards Internet of Things”, in Proc. IEEE 7th Annual Conference on Computing and Communication Workshop and Conference., Jan. 2017.

[5] S. Kumar and R. H. Goudar, “Cloud Computing-Research Issues,Challenges, Architecture, Platforms and Applications: A Survey” International Journal of Future Computer and Communication., vol. 1, no. 4, pp. 356-360, December. 2012.

[6] G. Ramachandra, M. Iftikhar and F. A. Khan “A Comprehensive Survey on Security in Cloud Computing” Procedia Computer Science- The 3rd International Workshop on Cyber Security and Digital Investigation (CSDI 2017)., vol. 110, pp.465-472, 2017..

[7] S. Mukherjee and R. Shaw, “Big Data-Concepts, Applications, Challenges and Future Scope” International Journal of Advanced Research in Computer and Communication Engineering., vol. 5, no. 2, pp.66-74, February.2016.

[8] S. Khan, K. A. Shakil and M. Alam, “Cloud-Based Big Data Analytics – A Survey of Current Research and Future Directions”, Big Data Analytics, pp. 595-604, October 2017.

[9] T. M. Bojan, U. R. Kumar and V. M. Bojan , “An Internet of Things based Intelligent Transportation System” in Proc. IEEE International Conference on Vehicular Electronics and Safety, December. 2014.

[10] V. S. Nagmode and S.M. Rajbhoj, “An Intelligent Framework for Vehicle Traffic Monitoring System using IoT” in Proc. IEEE International Conference on Intelligent Computing and Control, June.2017.

[11] S. Latif, H. Afzaal and N. A. Zafar, “Intelligent Traffic Monitoring and Guidance System for Smart City” in Proc. IEEE International Conference on Computing, Mathematics and Engineering Technologies (iCoMET), March. 2018.

[12] K. Wrona, “Securing the Internet of Things a Military Perspective”. in Proc. IEEE 2nd World Forum on Internet of Things (WT-IOT), December. 2015.

[13] A. R. Sfar, Z. Chtourou and Y. Challal, “A systemic and cognitive vision for IoT security:a case study of military live simulation and security challenges”. in Proc. IEEE International Conference on : Smart Monitored and Controlled Cities (SM2C), pp . 101-105, February 2017.

[14] G. Mois, S. Folea and T. Sanislav, “Analysis of Three IoT-Based Wireless Sensors for Environmental Monitoring” IEEE Transactions on Instrumentation and Measurement., vol. 66, no. 8, pp. 2056-2064, March.2017.

[15] M. S. Jamila , M. A. Jamilb , A. Mazharc , A. Ikrama , A. Ahmeda and U. Munawarc, “Smart Environment Monitoring System by employing Wireless Sensor Networks on Vehicles For Pollution Free Smart Cities” Procedia Enginering, vol. 107, pp. 480-484, 2015.

[16] F. Federicia, R. Alesiia, A. Colarietia, M. Faccioa, F. Graziosia, V. Gattullib and F. Potenzab, “Design of Wireless Sensor Nodes for Structural Health Monitoring applications”, vol. 87, pp. 1298-1301, 2014.

[17] R. Jafari, A. Encarnacao, A. Zahoory, F. Dabiri, H. Noshadi and M. Sarrafzadeh, “Wireless Sensor Networks for Health Monitoring”, 2005.