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An IoT based Sustainable Energy-Saving Urban Data Management (IoT-UDM) for Smart Cities

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ABSTRACT
This paper develops an energy-saving urban data management system subject to cloud environment and the proposed concept is used to manage the energy consumption in specific city. The cloud influence of IOT devices are used to communicate people with each other. Based on the communication intermediate of sharing and integrating is carried out upon internet technologies. Previous researches states that the big data analysis is complex. Hence, our proposed part contains different kinds of sensors such as traffic congestion, weather, smart home, water and vehicular sensor to collect the data. Considering Hadoop distributed file system (HDFS) to store larger data into tiny blocks and the decision making process are performed using machine learning algorithm. Therefore, the effectiveness of the proposed model is illustrated through a case of processing time and throughput. Ultimately, more scalable, flexible proposed concept is implemented and it provide better performance field.
Keywords: Smart city, Urban area, IoT-UDM, Cloud, Energy, Data, Machine learning.

I. INTRODUCTION

Generally, the migration of suburban and rural in cities is made the basic problem in city superintendent and urban existence. Therefore, the few of the complicated issues are listed as control of crime, power, health management, house, irrigation system, no job, studies, traffic and garbage gathering. Around the total population with eighty percentage of peoples are lived in cities and their requirements are randomly increased day by day [1]. So the government also planned to make smart cities but it is more expensive. Nevertheless, it effectively handles the challenging problem in urban cities. The observation of real-time application, expansion of urban area and pre-planned process the major part of smart city development [2]. Based on the requirement of user with real-time application such as storage, computing performance and electrical regions are handled effectively. Moreover, the analysis of big data is more complex in current technology and theses information are collected from media records, audios, sensor, query processing, smartphones and social media. In this paper, we effectively analyze the big data based on the energy-saving (elasticity) resource using machine learning algorithm.

The author [3] introduced the framework of context-aware information and the data are collected from smartphones. The energy consumption is accepted using sensors or cameras and there is no other recharge is required. Then the process is much useful to smart city organization but it requires an additional energy source. Joe Cloistral et al. [4] analyzed the housing expansion model with enlarger data sets. The smart city based valuable outcomes are obtained with the usage of the prototype with multi-functionality. The sensor is used to gather the biometrical information and it is not much suitable to health care detection and management also few safety issues are aroused because of the connectivity of neighbor. Nguyen et al. [5] suggested the Oliot-open city platform undertake smart city issues. The GSI can approve global principles of building. The key management harmonization is controlled using arbitration gateways. The open-source interfacing with vehicular information separation but it contains lot of challenging issues. Hayar et al. [6] established a collaboration of frugal sustainable social concept. It based on the cost efficiency of inducement method. The approach is based on cloud environment with possible to American countries due to larger expense. Kumar et al. [7] suggested aforementioned together with the user background and reduction in power consumption. The enhancement quality and making decision are not accurate but the system is connected by means of cloud environment. The scalability and sustainability are minimized using multilevel elasticity. Chen et al. [8] debated about the analysis of big data in smart city and proposed PM2.5 concept. The smart city populations are checked using various processes and the implementations are handled with cloud-based workout environment.

II. METHODOLOGY

The aim of the study herein has been to develop an energy-saved smart city. In this paper, we develop an energy-saving (elasticity) urban data management (EUDM) system that incorporates to the cloud environment. Therefore, the resource data such as traffic, water, weather, health and parking is used to handle energy consumption in smart city. The data are collected with the help of IOT devices such as camera and different kinds of sensor. Hence, the decision making process is carried out by means of machine learning algorithm [9].

Elasticity (Energy-saving) manager

The energy-saving process in urban area with the energy is collected using different kinds of sensors such as traffic congestion, weather, smart home, water and vehicular sensor. The energy-saving in smart cities are connected with many more IoT devices such as sensors and cameras. Similarly, the devices are used to collect the sensor message and location. Mainly, the sensor is connected to the smartphones to monitor the energy-saving process. Every day, the resource data like environmental issues, health care facilities, forecasting decision, traffic congestion, water and power management are collected and monitored by elasticity manager. The activation of sensors time is set with the usage of logical mobility tree [10]. Thus, the Smartphone with elasticity manager are used for the implementation these process. The battery life of the Smartphone is maximized because it is always connected to the power source using cloud. The Smartphone sensor with 3G or 4G antennas and global positioning system are used to identify the user location. The previously saved cloud data linked with all the IoT devices contain fixed longitude and latitude respectively. All the nodes provide resource data directly and better accuracy is obtained by the allocation of virtual machines.

❖ **Data processing and collection:**

In this section, the obtained energy-saving data IoT-UDM are carried out for data acquisition process such as data detection, integration and logging. Commonly, the smart city energy management process contains a larger amount of resources that are heterogeneous and contain larger computational ranges. Because of unavoidability, every smart city implementation anxiety is based on data computation.

❖ **Decision-making process:**

Thus, the endeavor of smart city energy management process is to deliver efficient resources such as environmental issues, health care facilities, forecasting decision, traffic congestion, water and power management. The samplers signals are performed using data acquisition, the digital machine of computer are used to operate the digital values from transform and real-time measurement. The structure of transform data is analog to digitalize and the operation is carried out with various data acquisition systems. Let us consider, the data is collected from the development section of worried smart city and the obtained data are subjected to the heterogeneous sensor. The collected data are associated with a cloud environment. The dataset is represented as $S_1, S_2, \ldots S_m$ with constant K statistical nodes are denoted as $N_1, N_2, \ldots N_{mk}$.

$$D = \sum_{j=1}^{m} S_j \qquad (1)$$

Therefore, the dataset value is expressed as $S = \sum_{j=1}^{k} NM_j$.

❖ **Data handling:**

Thereafter, the collected energy data set IoT-UDM are subjected to data handling operation using map-reduce concept. The resource data collection of open-source software Hadoop is used to divide the input data into small equivalent pieces. The Hadoop distributed file system (HDFS) is used to store larger data into tiny blocks of data. During division operation, the mapping functionality is used as evidence of block splitting. The pair of key value evidence is created using evidence reader. For the purpose of optimal performance in data division with the Hadoop of map task is performed in the specific node. The representation of map reduction is introduced over energy contamination dataset and the various energy values are collected. Therefore, the map function emits the stamp time based on the requirement of association value. All the stamp time values against the required association values that are decreased by group function as well as the threshold value limits are used for the value comparison. The limitations in the conventional map-reduce problems are carried out using yet one more resource negotiator and it is used to enhance the performance.

In this part, the classifications of resource event and decision creation are performed using decision making process in IoT-UDM. The high event stages are store by departmental level and there is no other lower stage event transformation. The independent outcome of spitting unit can post the decision of relevant smart city growth sections like smart cure, traffic congestion management section. Due to the correct analysis with decisions are properly analyzed by means of machine learning algorithm and the accurate notifications are collected. Based on the creation of any event with correct recipient is detected with the help of theses notification. There are various rules and set of threshold are created by the estimation of various dataset. Hence, the threshold limit values (*ThLv*) are used to store the exact limits and threshold value. Thus, the threshold limit value places the every resource dataset like water usage *ThLv* in support of buzzer the water stage, temperature *ThLv* used in the prediction of fire issues and etc. The event generation and the decision-making process are performed using machine learning algorithm. Also, different kinds of rules are achieved in the presence of *ThLv*. The energy consumption and execution time of the resource data are saved. Finally, the big data analytics of various smart city energy management processes are performed effectively.

III. RESULT AND DISCUSSION

Experimentally, the evaluation performance is checked in this section using various criterions. The implementation of smart city energy management is simulated using Hadoop with *JAVA* platform. The cloud environment is to run the testing application and create the energy-saving strategy. The proposed concept is evaluated using dependable and genuine dataset also it's based on the previous data. If the data is small means the variation of loading time data is never notified but the dataset values equal to the threshold variations are observed. We use the various size of test dataset for the determination of threshold value. If the values are above zero means few modifications are happened. The other clients with their organization works are handled by Hadoop. The data loading time of threshold is initialized by 900 MB. Consequently, the 1.7GB and 1GB threshold representation concept is depicted in Fig 2(a) and 2(b). The structure of proposed throughput is sketched in Fig 2(c). From this fig 2(c), if the size increases the speed reduced automatically. Therefore, the proposed method efficiency is higher when compared to other existing methods.

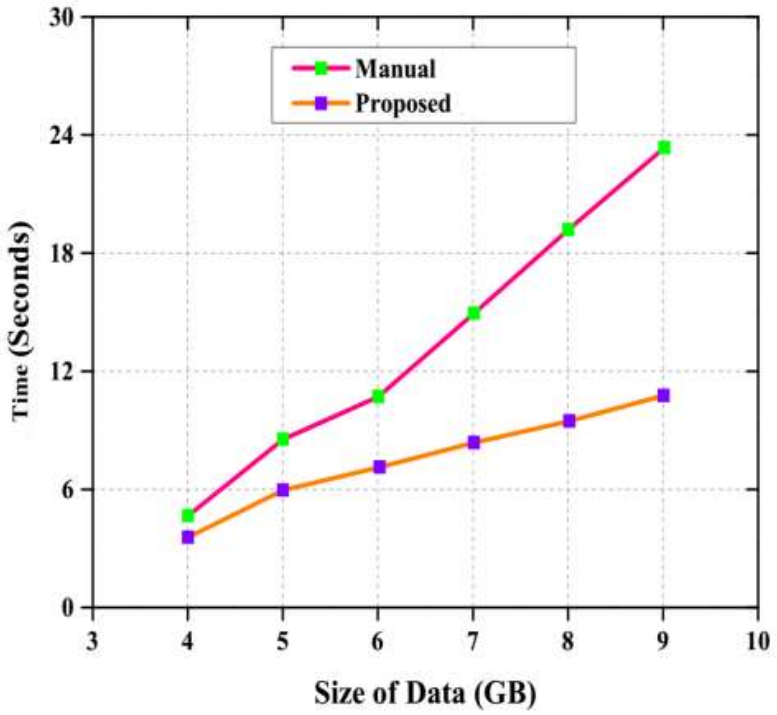

Figure 2: Customized instrument

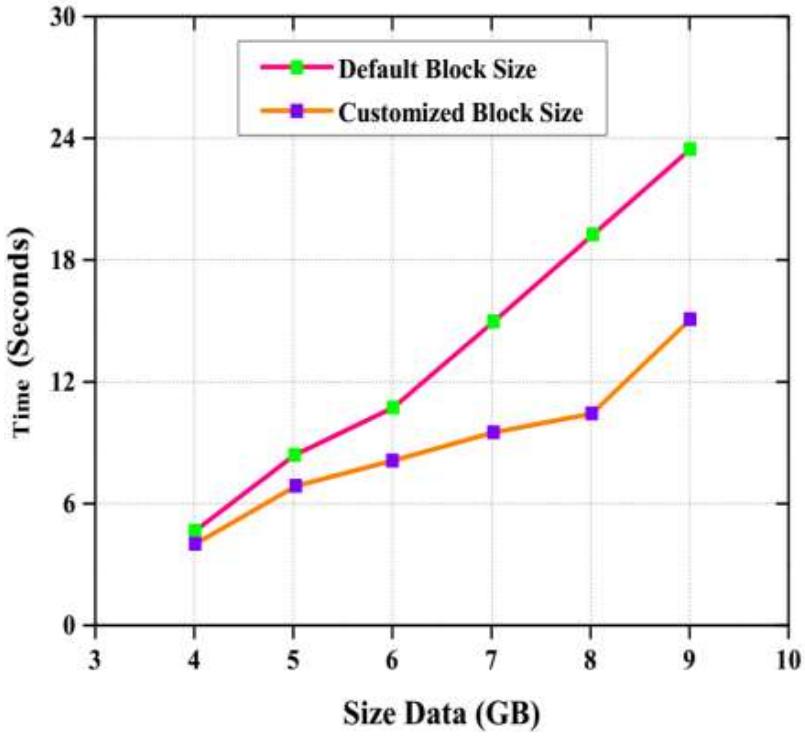

Figure 3: Block size threshold

The virtual machine allocation (VM) triggering is involved the upper threshold limit of 70%. Thus, the energy consumption is increased but the execution time is minimized. The cloud elasticity performance is estimated and not validates the artificial workload [The execution time and energy consumption are taken the threshold of upper and lower limits also two to six virtual machines are chosen for the detection of time and energy. The variation of upper and lower limit with smart city energy-saving application is illustrated in The new virtual machine oscillation, host distribution and redistributions are observed. The elasticity representation by the applications are listed out also the energy consumption managing is the part of information dispensation. Thus, the performance of energy-saving is better and efficient when compared to other existing methods.

CONCLUSION

The study presented in this paper developed to manage the energy IoT-UDM in smart urban city. A huge amount of data from the city is handled to evaluate the smart city architecture. The objective has been to set smart urban city so that the big city data analytics would be analyzed effectively. The Hadoop is used to make a real time smart city process also it provides the offline service. The proposed framework was implemented using *JAVA* platform and the dataset are collected from different energy-saving resources such as vehicular, surveillance, traffic, pollution and water in the city. The performance analysis of proposed concept is performed with the basis of processing time and throughput. Experimentally, six virtual machines are selected to analyze the performance of the energy consumption and execution time in smart city effectively.

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