Traffic Indexing Cloud Analytics Over Edge Network In IoT

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Abstract- *In this technology, the measurement of air quality is one of the difficult areas for the researchers. The main source of atmosphere pollution happens due to vehicles. The main objective of the project is to introduce vehicular pollution monitoring system using Internet of Things (IoT) which is capable of detecting vehicles causing pollution on the city roads and measures various types of pollutants, and its level in air. This project reports the status of air quality whenever needed for the environmental agencies and traffic management control agencies for better diversion of traffic based on the pollution levels in the particular area. The proposed system convinces the existence of wireless sensors for vehicle pollution system that concentrate in a straight forward user-friendliness of real time data through internet using Internet of Things.*

Keywords- Edge; Fog; Internet of Things

I. INTRODUCTION

The foremost source of pollution in cities is owing to vehicles. The proliferation use of vehicles in cities results in vital rise in the emission load of various toxins into air. As a result, increase in environmental problems which will affect the human health in metropolitan places. Air pollutants from taxies, cars and buses result in the damage of ground level ozone and other respiratory problem like asthma attacks. Transportation is main source for generating carbon monoxide that contributes 72% of total pollution in the metropolitan cities like Calcutta, Mumbai, and Delhi. At present, the Indian pollution control board has made the fitness certificate as compulsory for public and commercial vehicles once in a year to control the pollution. Pollution Under Control (PUC) certificate for every three months is mandatory for all group vehicles from the date of registration. In order to control the air pollution, the amount of air pollution needs to be monitored and vehicles responsible for polluting could be identified. IoT is become helpful in cities for monitoring air pollution from vehicles and also data related to the amount of pollution on different roads of a city can be gathered and analyzed[10].

The methodologies in sensing technology, particularly in the area of Wireless Sensor Networks (WSNs), it now endows environmental monitoring in real time at special and temporal scales[2]. This project specially aimed to operate the system using sensor network and gather the information about pollutant levels discharged by the vehicles. IoT is a new technology which draws the consideration for both academia and industry. IoT is realized as a network of things, each of which can be label using unique ID and convey based on standard communication protocols. IoT accord objects to communicate with one other, to approach information on the web, to store and collect data, and to collaborate with users, thereby creating smart, ubiquitous and perpetually connected environment[4]. To achieve such intelligence within the environments, big technological innovations methods and developments are needed. The researchers intellects that it will be potential to distinguish a newly built shape to IoT, collect with the crack of pervasive devices in the future. The vision of IoT is that of everyday life such as vehicles, roadways in public transport systems, wireless pill-shaped cameras in the system of digestive tracks for healthcare applications, air conditioner, or former household things can be attached with sensors, used to track data regarding the settings.

II. COMPUTING MODEL

A. Client Server model:

The main method that businesses to process data is a client-server model. This server gathers IoT devices data from the client end generally a Router. Server does the mandatory computation of the data. End users within an organization can store any number of files and documents on the file server, permitting end devices to conserve memory and processing power for use on local applications. By storing files on a central file server, other users within the organization can easily access these files, which allows for greater collaboration and sharing of information. Finally, with centralized services (such as file servers), organizations can also implement centralized security and backup procedures to protect those resources.

B. Cloud computing:

In Cloud Computing model the Servers and Services are spread all over the world in distributed data centers. Cloud computing allows IoT devices to contact applications from servers placed in the Cloud. In Cloud computing, data is coordinated across multiple servers, to facilitate servers in one data center maintain the same information as servers in another location. Cloud computing has explained many problems of the traditional client-server model. Still Cloud computing is not the best choice for delay-sensitive applications that require an immediate, local response. This led the IoT to use Fog Computing Model.

C. Fog Computing Model:

Fog computing creates a distributed computing infrastructure nearer to the network edge that conveys out easier tasks that require a speedy response. It reduces the data burden on networks. It enhances flexibility by allowing IoT devices to activate when network connections are vanished. It also develops security by keeping sensitive data from being transported beyond the edge where it is needed. The illustrative representation of fog computing model is shown below.

III. DATA ANALYTICS USING EDGE DEVICES

Commonly, air pollution situation is supervised by conventional air pollution monitoring systems with stationary monitors. These monitoring stations are highly reliable, accurate and capable to measure a wide range of pollutants by using the conservative analytical instruments, such as gas chromatograph-mass spectrometers. The hindrances of the conventional monitoring instruments are their huge size, heavy weight and extraordinary expensiveness. These lead to sparse deployment of the monitoring stations. In order to be effective, the locations of the monitoring stations need careful situation because the air pollution situation in urban areas is highly associated to human activities (e.g., construction activities) and location-dependent (e.g., the traffic choke-points have much worse air quality than average). Changes in urban arrangement, activities or regulation may affect both the species and the concentrations of air pollutants, which require relocating stations or adding new stations. These necessities are typically hard or even impossible to fulfill due to the cost inefficiency in acquisition and maintenance of the monitoring stations. Furthermore, the conventional monitoring instruments involve long-term time-consuming average models. The air pollution situation is updated hourly or even daily. Hereafter, the air pollution maps built by the conventional air pollution monitoring systems are with extremely low spatial and temporal resolutions.

IV. PROPOSED COLLABORATIVE DATA ANALYTICS PROCESSING

In order to rise the spatial and temporal perseverance of the air pollution information, researchers are forceful the air pollution monitoring systems to the limit by combining the low-cost portable ambient sensors and the Wireless Sensor Network (WSN) into one system which is known as The Next Generation Air Pollution Monitoring System(TNGAPMS). By exploiting the low-cost portable ambient sensors and the WSN, the air pollution information can be updated in minutes or even seconds. Likewise, the low-cost portable sensors enable the mobility and the feasibility in large-scale deployment of the sensor nodes. The spatial and temporal resolutions of the contamination data are significantly improved in TNGAPMS. TNGAPMS seals the gap between the conventional monitoring systems and the air quality models since the air pollution information at locations without monitoring stations is skilled by air quality models or estimations. TNGAPMS also ropes researchers recognize the distribution of the air pollutants more ably and truthfully to progress the air quality models. The public users can even scope their personal exposures to pollutants using wearable sensor nodes.

The outline of the anticipated system habits IoT to discourse the vehicular pollution in real-time applications. Two gas sensors CO_2, SO_x are used to monitor the pollutants continuously to maintain the quality of the air. The block diagram of the proposed air pollution monitoring system is shown.

- Cloud-assisted adaptive optimization of computing, communications and caching resources
- Cloud-assisted energy-efficient caching and task/data offloading
- Spectrum monitoring and dynamic spectrum management using collaborative edge-cloud processing
- Event-driven resource allocation and network management using collaborative edge-cloud processing
- Cloud-assisted security and privacy enhancement

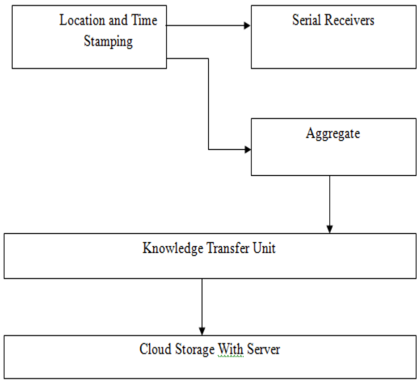

Figure 1. Single Unit Block Diagram

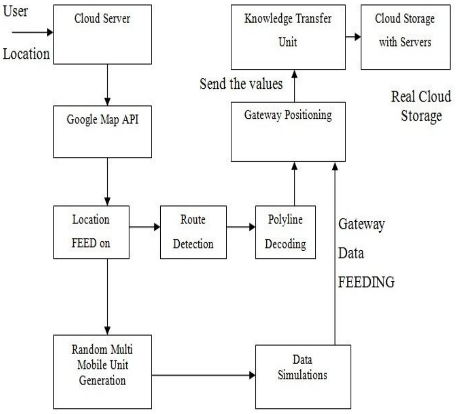

Figure 2. Multiunit Simulation Block Diagram

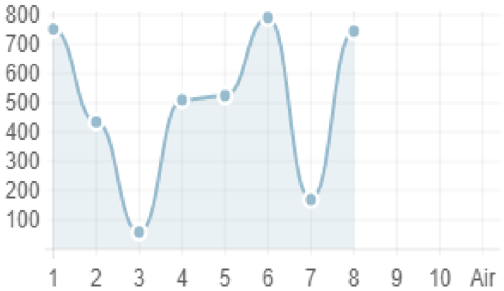

Figure 3. Example of Air Pollution Art Images

V. POTENTIAL ENABLERS, CHALLENGES AND FUTURE ENHANCEMENT

A. Coordination mechanisms between edge computing and cloud computing

In the suggested combined edge-cloud architecture, communication, computing and storage functionalities need to be vigorously allocated among the edge-side units, cloud and the things (devices/sensors) in order to switch the massive IoT data in the real-time. As well, there is a strong need to have the coordinated management of cloud computing and edge computing units in control massive IoT connections in a reliable and protected manner. In other words, effective coordination mechanisms between edge processing units and cloud processing units are decisive in order to appreciate this architecture effectively. In order to empower these interactions, suitable interfaces between edge processing unit and the cloud center, among different edge processing units, and between edge processing units and IoT devices/objects need to be defined.

B. Data-Analytics aware edge-cloud collaborative processing

One hopeful way of dealing with the big data in wireless IoT networks is to recognize the features of big data and to integrate this awareness in order to develop the system performance. In contrast to multimedia contents, IoT data has several peculiar features such as bursts nature, small data size and transiency, i.e., they expire in short time. The data collected from IoT sensor nodes can be compacted at the aggregator node before forwarding to the cloud, and also only certain features of the raw data can be removed and sent to the cloud for some specific applications.

C. Adaptive optimization of computing, communications andcaching resources

In contrast to the traditional way of managing computing and communication resources in a separate manner, future wireless IoT networks require novel solutions towards the adaptive optimization of computing, storage and communication resources at both the edge and cloud sides in order to deal with the massive amount of heterogeneous data. In this context, it is important to adapt the system model and decisions/control actions to be taken based on the

Global knowledge available at the cloud side and instantaneous information collected at the edge-side. Moreover, objective functions can be adapted based on the varying state of the

System as well as instantaneous requirements from the end-users. Besides, in order to facilitate real-time collaboration between the cloud computing and edge computing units, it is crucial to optimize the involved backhaul/feedback links under the transmission bandwidth constraint without compromising the quality of the links.

VI. CONCLUSION

This paper presented the design and development of IoT centered pollution monitoring system for green revolution. The hardware architecture and software execution are argued in detail, the air and sound pollution data's where collected from altered places and it is put in storage in cloud storage for the resource allocation processing. Edge detection is done on those collected data and its pattern is compared. Though, these paradigms have their own advantages and disadvantages. Cloud computing provides a centralized pool of storage and computing resources and has a global view of the network but it is not suitable for applications demanding low latency, real-time operation. On the other hand, edge computing is suitable for the applications which need real-time treatment, mobility support, and location/context awareness but does not usually have sufficient computing and storage resources. The basic features, key enablers and the challenges of big data analytics in wireless IoT networks have been described and the main distinctions between cloud and edge processing have been presented. The enabling technologies, moreover, have reached a level of maturity that allows for the practical realization of IoT solutions and services and also been designated as a relevant example of application of the IoT paradigm to smart cities.

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