A Novel Model for Healthcare Emergency using Fog Computing

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ABSTRACT

The number of road accidents is continuously increasing and immediate help is required during an accident. VANET are connected internet and they contain sensor which is activated during an accident. These sensor share accident location. We proposed a model in which the sensor passes data to the fog layer for quick processing. The fog layer contains fog nodes which is used for computation. These nodes process sensor data and find nearby possible immediately. Our proposed model is compared with the cloud computing model based on response time and network bandwidth. Simulation results show that the proposed model outperforms the cloud computing model.

KEY WORDS: FOG COMPUTING, VANET, HEALTHCARE

INTRODUCTION

The objective of Vehicular Adhoc Network is used to improve the safety of driver and VANET are sharing data among each other viz. traffic condition, traffic signals. Now a days the number of road accidents has been increased significantly and the patient will have to rush to the hospital as early as possible. But hospital finds it difficult to send an ambulance from the hospital to patient's location and if there is a serious case then the patient might even die if not taken to the hospital in time. Hence system is required which find a nearby hospital in case of an accident in real-time. Vehicular Cloud Computing (VCC) can be used to perform data storage and computation in real-time. In general, VANET are connected to the cloud for data storage and computation but there may communication latency for

data computation but it does provide concrete solution due to latency-sensitive requirement. Hence computation nodes are required which are close to VANET and perform processing of data immediately. Fog computing can be used which is place close to the proximity of the application. It contains computing nodes that are placed near to application and perform computation in real-time.

In this paper, we used fog computing to provide quick response in case of road accident. All VANET contains a collision sensor and are connected to fog computing. If an accident happens then sensors in VANET share location, images, and videos to fog nodes. Fog nodes perform computation of data and find nearby hospitals from the accident location. It share accident location, images and video to nearby hospital and calling out for emergency care. We have also used cloud computing to compare the performance with the fog computing model on the basis of response time and latency for communication on the basis of response time and network bandwidth.

ARTICLE INFORMATION

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The objective of the paper is follows

- To develop faster and better Emergency Healthcare Services.
- To develop a fog computing architecture for faster processing of request.
- To develop a model to reduce response time and latency for processing of request.

The rest of the paper is organized as follows. Section 2 describes related work while the proposed model is discussed in Section 3. Performance evaluation describe in Section 4 while Section 5 concludes the paper.

Related Work: Numerous article has been published for application of fog computing in various domains. They are as follows. Fog computing in face identification has been discussed in [Hu P,2017]. Fog computing used in military applications to take spontaneous decision making by the military officials [Lanka D,2017]. Fog computing can be used for smart services in smart cities [Giordano A, 2016]. Kim et. al.[O. T. T. Kim, 2015] presented the use of fog and cloud computing for solving the parking problem. The proposed model by the author relieve traffic congestion, reduce air pollution, and enhance the driving experience. Up to know our best knowledge, we are the first to propose a fog computing model for providing emergency help during road accidents.

Figure 1: Proposed Architecture

Figure 2: Sequence Diagram of Proposed Model

Proposed Architecture: Proposed architecture is shown in Figure 1. It consist of three layers viz. VANET layer, fog layer and cloud computing layer. Sequence diagram for proposed model shown in Figure 2.

- Layer 1 (VANET): This layer consist of Vehicular Adhoc Network (VANET) which are connected to internet. It consist of sensor and they get activated during accident. These sensor share accident location, images and video to fog computing.
- Layer 2 (Fog Computing): This layer contains fog nodes for computation. Data send from VANET has been processed in this layer and it find nearby hospital as well as contact for emergency care. If required, it also send to cloud computing for storage.
- Layer 3 (Cloud Computing): This layer contains data server for permanent storage of data. Data pass from fog layer has been stored in this layer permanently.

Table 1. Simulation Parameters

Model	Intel PC
Processor	2.00 GHz Intel(R) Core(TM) i3-5005U
Operating System	Windows 10
RAM	4 GB
Number of Nodes	10
Task Arrival	Poisson Distribution
RAM	512 MB
MIPS	1000
Simulation start at	10 request
Simulation end at	50 request

Figure 3: Response Time Comparison

SIMULATION RESULTS

The proposed model is implemented in iFogSim Simulator which is configured on Intel Machine. Simulation consist of ten computing node for fog and cloud environment. The number of requests are varied from 10 to 50 in the interval of 10. Table I shows simulation parameters.

Figure 4: Bandwidth Comparison

Response Time Comparison: Here request are processed in fog and cloud environment and from Figure 3, it is observed that that fog computing provides quick response for processing of request as compared to cloud computing. **Bandwidth Comparison:** We have compared the network bandwidth required for the processing of requests in fog and cloud environments. With the increase in the number of requests, network bandwidth also increases. In figure 4, the x-axis represents the number of requests and the y-axis represents bandwidth. From simulation results, it is observed that less bandwidth is required for processing requests in fog computing as compared to cloud computing.

CONCLUSION

Immediate help is required during an accident and latency is not desirable. All VANET are connected to the

internet and contain sensors that share accident location and other information to the fog layer. The fog layer performs data processing and find nearby emergency hospital. The proposed model has been compared with the cloud computing model and simulation results show that the proposed model outperforms the cloud computing model in terms of response time and network bandwidth.

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