CC REPORT ASSIGNMENT – 2

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The Two Research Papers are:

1.Delay-Aware Accident Detection and Response System Using Fog Computing

Date of publication May 1, 2019.
By, BILAL KHALID DAR, MUNAM ALI SHAH, SAIF UL ISLAM, CASTREN MAPLE, SHAFAQ MUSSADIQ, AND SULEMAN KHAN.

2. An Overview on Edge Computing Research
Date of publication May 6, 2020,
By, KEYAN CAO, YEFAN LIU, GONGJIE MENG, AND QIMENG SUN.

PAPER – 1
SUMMARY

1) Introduction:

By definition, emergencies are unpredictable, and effective emergency management depends heavily on rapid response.

Each year, a significant number of deaths caused by excessive delays in the rescue operation. Roads with modern infrastructure and vehicles with smart technology can both be key factors in the quick identification and notification of roadside problems.

Therefore, to solve the problem in any nations, low-cost solutions are needed. Roadside incident detection and reporting have started to be done using Internet of Things (IoT)-based systems.

Fog computing has emerged as a middleware paradigm that brings cloud-like resources closer to end devices in order to address the problem of latency.
The hospital's emergency department is notified of the accident, and an ambulance is dispatched to the scene. Furthermore, the victim's family contacts are informed of the accident. All necessary computation is done on the nearest available fog nodes.

2) Objective of the work:

The provision of timely assistance to accident victims is a critical requirement for reducing the impact of vehicular accidents. To that end, developing appropriate notification and response strategies is critical to saving human lives. Numerous statistics show that the number of traffic accidents is rising year after year. According to the World Health Organization's Road Traffic Facts, 1.24 million road accidents occur worldwide each year.

The victims of a significant majority of car accidents are helpless to ask for help. In such circumstances, a plan of action is necessary, which calls for alerting the appropriate authorities and giving the victims prompt medical care. Such judgments are typically made by humans, which adds needless time.

We suggest a fog-based delay-aware accident management system (we term it ERDMS) to overcome the aforementioned issues. Reduced response and rescue times are the goals of the proposed system.   Using a smartphone's built-in sensors to find an accident lowers the overall system cost. The necessary data is gathered through a smartphone application that is created utilising the device's sensors. GPS is used to gather the location data.

3) Major contributions:

Natural or man-made disasters can occur, and in both cases, one of the most important factors in reducing loss of life is the time required for response.

Because of the centralised nature of the service, cloud-based accident detection and disaster management systems may face latency and bandwidth challenges. Fog computing, an emerging concept that promises lower latency, mobility support, increased resilience, and scalability, can help address these issues. Furthermore, by utilising smartphone sensors, emergency detection and management systems in legacy vehicles can be made more affordable and simple to deploy.

4) Approach Referred

(ERDMS). It is a fog-based system that makes use of fog computing's benefits to cut down on overall system latency. It replaces the requirement for an on-board processing unit and external sensors and lowers system costs by using the sensors that are already present in a modern smartphone to detect an accident and interpret data. The fog servers receive the data gathered from the smartphone sensors.

5) Experimental Details

➢ ARCHITECTURE OF THE PROPOSED SYSTEM:

The interface and devices are located in the first layer. The second layer is made up of fog nodes. The database is held in the next layer.

Finally, the cloud resources are made available at the final layer. The data is collected using smartphones, and an Android interface is provided for vehicle and ambulance drivers, as well as a web interface for the hospital.

➤ SYSTEM IMPLEMENTATION (ACCIDENT DETECTION PHASE)

The smartphone's three built-in sensors are used. These include an accelerometer, a GPS sensor, and a microphone. To detect an accident, thresholds are set for each sensor to determine whether or not an accident has occurred.

The gravitational force is calculated using an accelerometer and GPS. If this value is greater than 4, an accident can be identified using previous research. However, using this value alone results in a high false positive rate. The speed of the vehicle is also taken into account when calculating the severity of the accident. if a vehicle's speed period variation is greater than 2.06, the vehicle is considered to be in an accident state. The microphone is also used to identify an anomalous acoustic event to improve the reliability of ERDMS.

$$
\begin{cases}
1 & if \ \left(\dfrac{AC}{4G} + \dfrac{Noise}{140db} \right) \geq Accident\ Threshold \\
& \quad AND \left(Speed \ > \ \dfrac{24km}{h} \right) \\
1 & if \ \left(\dfrac{AC}{4G} + \dfrac{Noise}{140db} + \dfrac{SVP}{2.06} \right) \geq Low\ Speed\ Threshold \\
1 & if \ \left(\dfrac{AC}{4G} + \dfrac{Noise}{140db} \right) \geq Accident\ Threshold \\
0 & Otherwise
\end{cases}
$$

$$(1)$$

where

- AC: Smartphone Acceleration
- Noise: Sound value in dB determined by smartphone
- SVP: Speed variation period
- Speed: Speed value calculated through G-Force
- Low-speed threshold: threshold to detect accident at low speed which is 1

➤ EMERGENCY RESPONSE AND NOTIFICATION PHASE

Once the location is determined, a nearby ambulance is notified via a notification sent from the victim's Android device, along with the necessary information. Furthermore, when a user instals the application, they are asked to provide information about at least two family members or friends who will be notified in the event of an accident.

As a result, when an accident occurs, an SMS is generated and information about the affected person and hospital is shared with the two contacts.

➤ ANDROID APPLICATION

When an accident is detected, the user is shown a 10-second warning to identify the case in which this was a false alarm. If the alarm is not cancelled, it is determined that an accident has occurred, and a plan of action is implemented, which includes sending information to the nearest hospital, notifying close contacts, and calling an ambulance.

6) Performance measuring metrics

The system's primary goal is to achieve low cost and lower latency when compared to similar solutions that use cloud-based environments.

To validate the claim, we ran simulations with iFogSim, which provides a discrete event simulation of IoT, fog, and cloud environments. It enables the functionality of IoT devices generating traffic, network management, scheduling policies, fog nodes, and cloud data centre configurations.

Furthermore, various performance metrics can be calculated using the simulations.

➤ CLOUD-BASED SCENARIO

The proposed system is first tested in a cloud-based scenario, in which the smartphone sends data to the cloud for processing. Figure 9 depicts the cloud scenario's topology. The actuators and sensors are located in layer zero, and data is sent to the cloud via routers.

➤ FOG-BASED SCENARIO

The ERDMS fog-based scenario consists of two fog nodes connected to the cloud via a proxy server. Once again, the actuators and sensors are at zero.

Different configurations are used in both scenarios.

The number of smartphones and users varies by configuration. Then, all configurations are evaluated in order to compute latency and network usage.

7) Results/Outcome:

For each scenario, network usage is calculated in megabytes.

It is obvious that fog computing saves bandwidth, whereas cloud computing uses more network data while transmitting data. When using the cloud for computing and storage, all jobs are routed to the cloud data centres. These jobs travel the entire network from origin to destination. The Internet backbone is used in this case. It results in increased utilisation of core network resources.

It compares the execution time of a fog node to that of a cloud server. As the number of devices increases, the benefits of the fog-based ERDMS become more apparent because computation is performed with lower overall latency and bandwidth usage.

By utilising fog computing, the proposed system overcomes the challenges faced by cloud-based systems.

When compared to similar OBU-based solutions, the system developed in this work uses smartphone capabilities to reduce costs. The system also saves money and time by reducing the need for human intervention through automated emergency management.

8) Limitations of the work and future scope:

Limitation:

The evaluation of the proposed scheme in a simulated environment is one of our study's limitations. We used a cutting-edge simulation environment, but it cannot perfectly replicate all real-world scenarios. As a result, the overall solution's generalisation is limited.

Future Scope:

In the future, we plan to evaluate an entire ERDMS in a real-world environment to monitor its performance in real time.

Furthermore, we will work to improve the accuracy of accident detection. In addition, we intend to integrate smart traffic signalling for the ambulance in order to reduce overall rescue time and enable smart transportation. We also intend to address potential privacy and security concerns that must be addressed before any real-world implementation on our system can be built.

Observation of the study:

1. How does the design of the study address the research questions?
   The cloud is used to compute, manage, and store information in the majority of systems developed for this purpose.

   However, the centralization and remoteness of cloud resources can lead to increasing delay, which raises concerns.
   There are severe questions about its viability in emergency scenarios; in life-threatening situations, all delays should be avoided to the greatest extent possible.

2. How convincing are the results? Are any of the results surprising?
   Results are astounding and highly persuasive.
   Some Results are surprising about low cost and decrease in the latency.

3. What does this study contribute toward answering the original question?
   Study includes testing the suggested plan in a simulated setting. Although we employed a cutting-edge simulation system, not every real-world circumstance can be perfectly simulated in it.

4. What aspects of the original question remain unanswered?
   It is still difficult to respond quickly to incidents involving older automobiles in nations where the installation of such systems is not required.
   However, a lot of the suggested solutions still have a big problem with latency.

PAPER – 2
SUMMARY

1. Introduction

Intelligence has grown in tandem with the advancement of intelligent society and the continuous improvement of people's needs involved a variety of industries as well as people's daily lives in society.

Edge devices have permeated all aspects of society, including smart homes and autonomous vehicles in transportation, cameras, intelligent production robots in intelligent manufacturing, and so on.

Cloud-based big data processing has many shortcomings due to the continuous and massive growth of data volume and various data processing requirements:

Real time and security and privacy.

2. Objective of the work

The fast expansion of data volume and the demand on network capacity are downsides of cloud computing.

In comparison to Edge computing, as opposed to typical cloud computing, provides benefits in reaction speed and real-time. Because edge computing is closer to the data source, data storage and computational functions may be performed in the edge computing node, reducing the need for intermediary data transfer. It prioritises user proximity and delivers more intelligent services to users, enhancing data transmission performance, providing real-time processing, and lowering delay time.

Edge computing provides consumers with a range of quick response services, which is especially significant in the fields of automated driving intelligent manufacturing, video surveillance, and other location awareness.

Main Two Advantages are Security and low cost.

3. Major contributions

With the advent of the Internet of Everything and the advancement of 5G, edge computing is seen as one of the important technologies in the future generation of communication networks, after the Internet of Things and artificial intelligence.

Many firms are focusing on the reference architecture for edge computing. This part begins with a broad overview of edge computing architecture, followed by a comprehensive explanation of the reference design suggested by the edge computing industry alliance (ECC) and the Linux foundation.

The cloud-edge cooperation structure is commonly separated into three layers: the terminal layer, the edge layer, and the cloud computing layer.

The device in the terminal layer is both a data consumer and a data provider. Only the perception of the various terminal devices is evaluated in order to decrease terminal service latency, not processing power.

4. Approach Referred

➢ EDGE COMPUTING REFERENCE FRAME 3.0

We need to simulate knowledge of the physical and digital worlds.
An underlying service layer connects the complete framework, including management services, data lifecycle services, and security services, in the edge reference framework.

Management services provide unified management by monitoring the architecture's operation and giving information to the management platform.

Achieve the four objectives listed below:
1) Create a real-time and systematic cognitive model of the physical environment in order to create collaboration between the physical and digital worlds.

2) Create reusable knowledge model systems based on modelling methods in each vertical sector, and complete cross-industry ecological collaboration.

3) System-to-system, service-to-service, and other model-based interfaces for interaction, to accomplish software interface and development language decoupling and decrease system heterogeneity.

4) Capable of successfully supporting the development service, deployment operation, data processing, and security life cycles.

➢ Edge X FOUNDRY

Edge X Foundry is a Linux Foundation-hosted neutral open source project that offers a global open architecture for computing on the edge of the Internet of Things. The framework, which is hosted on a reference software platform that is totally independent of hardware and operating systems, enables a plug-and-play component ecosystem to unify the computing open platform at the edge of the Internet of Things and expedite solution implementation.

5. Experimental Details

➢ *TRAFFIC OFFLOADING TECHNOLOGY*
Wireless networks have the potential of traffic offloading in order to realise the localisation, short-distance deployment, and low-latency, high-bandwidth transmission capabilities of commercial applications in wireless networks.

The offloading of edge network traffic is critical in mobile edge computing. To preserve backhaul bandwidth, minimise latency, and promote the spread of other MEC services, traffic offloading is used to offloading traffic that meets specific offloading rules to mobile edge networks Reference suggested an energy-efficient traffic loading mechanism for mobile users in a two-layer heterogeneous wireless network. Under typical network conditions, experimental results demonstrate that the approach can save up to 34% of energy.

- ➢ *CACHING ACCELERATION*

  Base station caching, mobile content distribution networks, and transparent caching are all examples of mobile edge caching systems. Caching acceleration technology can increase information distribution efficiency and user experience.

  At the same time, edge caching can reduce the user-requested network delay, consequently improving the user's network experience. Furthermore, edge caching can help to open up the mobile network resource environment and deliver more services to tenants and users.

  Reference proposed a cognitive agent (CA) to assist users in caching and performing activities on the MEC ahead of time, as well as to coordinate communication and caching to relieve pressure on the MEC.

6. Performance measuring metrics

The preservation of user identity privacy in the edge computing paradigm has received little attention, with only a few exploratory research findings in the mobile cloud context.
The credentials of mobile devices will also be updated in real-time in accordance with the mobile cloud packet switching mechanism to enhance the performance and security of the system and thwart attempts at credential theft.

- ➢ EDGE CALCULATION AND 5G

  It is critical at this time to develop a dependable, relevant, and executable business model. 5G qualities like as fast processing and low latency can provide a new means for rapid reaction while also optimising the end, edge, and cloud. This edge computing capability can intelligently distribute resources among Internet of Things, edge, and cloud devices based on factors such as user experience, power consumption, computing load, performance, cost, etc., offering a new method for joint optimization.

7. Results/Outcome

Explains the edge computing model in terms of fundamental principles, architecture, important technologies, security, and privacy protection. Edge computing provides data storage and computation at the network's edge, as well as nearby Internet intelligent services, supporting the digital transformation of many businesses and addressing the data diversification requirements of various industries. Edge computing has emerged as a prominent research topic Edge computing will not take the role of cloud computing. In terms of network, business, application, and intelligence, the two should coexist, complement each other, and evolve in a coordinated manner to aid the industry's digital transformation to a greater extent. To get in-depth analysis and more meaningful analysis outcomes, all data on edge nodes must still be summarised in the cloud. As a result, cloud computing continues to play a significant role in the development of gradually intelligent Internet of Things devices.

8. Limitations of the work and future scope

In addition to maintaining data integrity when developing an integrity audit scheme, data storage servers (edge data centres) and data owners (edge devices) have constraints in terms of processing power, storage capacity, network speed, and so on. Degree is also a significant consideration.

Because of the resource constraints of edge terminal storage, computing, and battery capacity, traditional and more complex encryption algorithms, access control measures, identity authentication protocols, and privacy protection methods cannot be used in edge computing.

Edge computing will become more important in the future as the Internet and human society continue to evolve, effectively promoting the development of various industries. It is widely used in Content Delivery Network (CDN), industrial Internet, energy, smart home, smart transportation, games, and other fields.

Observation of the study:

1. How does the design of the study address the research questions?
   Edge computing offers data storage and computation at the network's edge in addition to nearby Internet intelligent services, assisting many organisations in their digital transformation and meeting the demands of many industries for data diversity. Edge computing has become a popular area of study.

2. How convincing are the results? Are any of the results surprising?
   The outcomes are stunning and quite convincing.
   Some Results are surprising about new sectors that 5G Wireless technology has made possible is edge computing.

3. What does this study contribute toward answering the original question?
   Edge computing's debut has accelerated the growth of the Internet of Things and significantly advanced the realisation of an intelligent society.
   Edge computing has thus gained attention from scientists both domestically and internationally. The primary topics covered in this part include important technology, data security, and privacy protection.

4. What aspects of the original question remain unanswered?
   However, as the Internet of Things becomes more and more commonplace in people's lives, more and more devices are becoming connected to it, and a lot more data is being produced as a result.
   Cloud computing's network capacity hasn't been able to keep up with the demands of time-sensitive systems and real-time performance.

←THANK YOU→