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Sensor Networks
(700.460)

Can Video as a Service Paradigm Lead to the Future Internet of Video Thing?

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1. Internet of Things (IoT) and Internet of Video Things (IoVT)

The Internet of Things (IoT) describes the network of physical objects—"things"—that are embedded with sensors, software, and other technologies to connect and exchange data with other devices and systems over the Internet (Sheth, 2014).

IoVT is an integrated attempt of computer vision sensors, networking, video or image processing, and information storage systems (Benrazek et al., 2023). IoVT has become an emerging class of IoT systems that are equipped with visual sensors at the front end.

2. The IoT ecosystem comprises 3 key components

Devices & Sensors: IoT devices are equipped with smart sensors that collect data from the physical environment (Balgi & Dukkipati, 2019).

Connectivity: IoT devices connected with Wi-Fi, Bluetooth, cellular networks, and Low-Power Wide-Area Networks (LPWAN) to transmit data to the cloud and enable seamless data exchange (Sheth, 2014).

Cloud-based computing and data analytics: Cloud-based platforms provide the necessary computing power through Advanced analytics algorithms, AI techniques, and storage capacity to handle the massive volume of IoT data (Balgi & Dukkipati, 2019).

3. Overview of Video as a Service (VaaS)

Video as a Service, or VaaS, refers to a cloud-based model that enables the delivery of video content and services over the Internet. It encompasses a range of functionalities, including video capture, processing, delivery, and management, all offered as services through the cloud which arrange scalable and flexible solutions for organizations and individuals to leverage the power of video without the need for extensive infrastructure and resources. The VaaS consists of Video Capturing, Video Processing, Video Delivery and management .

4. Convergence of VIDEO AS A SERVICE (VaaS) and IoT

This Convergence represents a revolution in integrating video capabilities into IoT devices and systems and enabling the emergence of the future Internet of Video Things.

Brief to the point, we can enhance monitoring, gain deeper insights through video analytics, and make more informed decisions.

Some key points highlighting the convergence of VaaS and IoT are Enhanced Monitoring, Advanced Video Analytics, Smart Real-time Decision-making, and Seamless Integration (Kusuma, 2015).

5. Benefits of the VaaS Paradigm for the Future Internet of Video Things

It brings numerous pros such as Scalability by handling large-scale video data from IoT devices, Flexibility in integrating with existing IoT infrastructure, Real-time decision-making through video analytics with much more accuracy, Cost Efficiency by reduced hardware requirements and maintenance costs, Enhanced User Experience through integration of VaaS with IoT devices, etc. (Wu, Wang, Zou, & Ni, 2023)

6. VAAS Applications on the Internet of Video Things

Retailer Sector: Consumer behaviour is one of the most arguable research and practical-level subject areas due to its significant impact on businesses (Kusuma, 2015). IoVT helps track the number of visitors to the shop and their demographic factors.

According to Benrazek et al. (2023), video surveillance is most important to developing smart cities as it can easily be used to improve the security of people.

Traffic surveillance systems use fog systems to monitor real-time vehicles on the roads and make rapid decisions (Benrazek et al., 2023).

IOVT can work with the office to eliminate outdated pass and door locking systems. This method can be used to implement a face recognition system to improve security within the organisation (Nisha & Urvashi, 2023).

IoVT takes emergency response activities to the next level by supporting the capture of real-time data, identifying the affected area, number of people, and assets, and identifying the most possible way to handle rescue operations (Mohan et al., 2017).

IOVT can be used in home management to manage the energy, safety, and security of people.

automotive industry: IoVT leads to the identification of other vehicles and elements in the environment to drive safely (Hazra, 2023).

Industry inspection: cameras and visual sensors can be used to monitor and maintain equipment (Hazra, 2023).

Smart agriculture: this can be used for crop monitoring, pest detection, and irrigation management (Hazra, 2023).

Healthcare monitoring: IoVT helps to monitor the patient remotely. In addition, this can be used for wildlife conservation and sports analytics.

7. Challenges and Considerations

According to Sammoud et al. (2017), devices used for IoVT improvised to share multiple blocks to facilitate real-time streaming of video. It is essential to focus on the approaches to distributed or partial video encoding, intra-prediction processes, efficiency of transformation and compression, and video streaming over low-power technologies. Sensors connected to the internet are the main way for capturing data in IoT systems to get reliable data, and cameras are the main sources in IoVT (Mohan et al., 2017). So, the camera should be capable enough to capture real-time, rich contextual and behavioural information related to traffic on highways, animals, natural reserves, and damages after natural disasters such as earthquakes, tsunamis, etc. However, when increasing the number of devices that are used, the data supply increases.

The second challenge with IoVT is increasing the amount of video that is collected from the different types of cameras around the world (Mohan et al., 2017). The third challenge that arises with the IoVT is the bandwidth of the network. According to Mohan et al. (2017), when a vast amount of video data is generated from different types of cameras, IP video traffic also increases. but the current Metropolitan Area Networks (MAN), which come with 100Gbps, can support a maximum of 12,000 users uploading 1080p video over the Internet (Mohan, et al., 2017). Hence, bandwidth issues will arise. When the network cannot support the video data, the quality of the video will decline, which may affect the accuracy of analyses and applications that depend on the data. Therefore, energy is the most important area to consider. In a disaster period, it is essential to retrieve real-time data for the emergency response team to support the affected team. but the damage to the network links may affect the bandwidth to share the information, which may be another big issue when transforming with IoVT. Benrazek et al. (2023) highlighted the bandwidth issues as well as storage capacity and dedicated resources for processing.

The fourth challenge with implementing IoVT is processing video data in real time. The development of deep learning and artificial intelligence leads to the easy analysis and processing of a larger set of data. The data processing on the end device or the intermediate device, such as the cloud may be effective (Mohan et al., 2017). In addition, it can develop a system to get the essential information from cameras and not get all the information that is shared by other devices. This also helps to reduce network traffic.

8. Future trends and opportunities

The researcher identified that autonomous vehicles can be identified as future trends in IoVT (Mohan et al., 2017). However, IoVT in organizations may influence the privacy concerns of employees, leading to low productivity. This is because the management can criticize their employees with evidence. This gives better business insight as IoVT can monitor consumer behaviour within the shop, which leads to re-designing product placement and assortment. The video data reveals real-time data, which leads to better decisions.

9. Conclusion

The video as a service paradigm can be used in the future by adapting and following specific steps, such as fog computing and face recognition, to minimise the massive data transmission time. The second is to use cloud computing due to its high computing power.

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