Chapter 2
CVSS:
A Cloud-Based Visual Surveillance System

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ABSTRACT

A large amount of surveillance videos and images need sufficient storage. In this article, an architecture of cloud-based surveillance systems and its modules will be designed, the Cloud-based Visual Surveillance System (CVSS) will be implemented on a private cloud using a Virtual Machine (VM). The users are able to link their cameras to the CVSS system so that the goal of this design can be achieved. The authors' CVSS system is able to push notification messages of captured videos to receivers, and their users could receive a surveillance video along with its events. The CVSS system fully makes use of the merits of cloud computing, which make it more advanced as stated in the evaluation section of this article. The contributions of this article are to be implemented in the CVSS system with: (1) video stream input, (2) intelligent visual surveillance, (3) real-time video transcoding and storage, (4) message pushing and media streaming output.

1. INTRODUCTION

Visual surveillance is an application of security engineering, the functions of a surveillance system include camera deployment and calibration, video and image recording, surveillance data transmission, etc. Traditional visual surveillance refers to analog monitoring, its infrastructure includes a front-side

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camera, transmission cable, and visual monitoring platform (Hossain, et al., 2016). Because traditional surveillance systems are lack of intelligent computing, therefore it is "passive" or "not smart" (Zhao, Cui & Zhang, 2012). Cloud computing is a storage oriented system that is growing rapidly in recent years. Video and image storage shows its challenges with the substantial requirement of infrastructure because visual surveillance needs storage facilities like big data that may be costly to any users. Also, once the storage disks are full or damaged, the huge data will be in risk, and thus the backup is absolutely needed (Hossain, et al., 2012). With timely data backup, users can easily access the data in anytime without worrying about cloud facilities (Bogardi-Meszoly et al., 2006). Visual Surveillance as a Service (VSaaS) (Kim, et al., 2009) follows the cloud computing paradigm SaaS which has outperformed than other services of traditional surveillance systems.

The VSaaS is primarily driven by numerous pivotal factors such as dynamic technology, cyber security, remote access, etc. A Cloud-based Visual Surveillance System (CVSS) allows any users to benefit from upfront capital costs (Qi & Yu, 2006). The surveillance system therefore lessens the resources and human workload. The purposes of this paper are to design and implement the CVSS system that has better functions, satisfactory performance and friendly user experience than those existing ones (Jiang et al., 2012). As visual surveillance requires sufficient space to store the big surveillance data, we think the first research problem of this project is how to dynamically allocate enough space to deposit these videos and images from surveillance sensors. We believe pushing notifications is an important feature of a cloud-based system. Hence, our CVSS system could deliver any latest events to the user's terminals in real time so as to achieve surveillance alarm making timely. In order to make the CVSS more intelligent, we need integrate all components into the system. We set up the system with the functions such as face recognition, motion detection, license plate recognition, etc. The rest of this paper is organized as follows. Section 2 will present our system design, we will describe the implementation in Section 3 while Section 4 illustrates our tests and analysis, we will conclude this paper and depict our future work in Section 5.

2. SYSTEM DESIGN

The requirements to develop the CVSS system are necessary, especially for those cloud devices and Apps. In the CVSS system, our users can watch and get videos from anywhere in the world (Wo, et al.,2012). By using Network Video Analytics (NVA) module, when a surveillance event is captured, the users could get the push notification that includes event entities such as "who", "where", "what", "why", "when", etc. (Zheng, 2009) The users are able to access the surveillance video footages associated with the event via Cloud Apps.

Our CVSS system consists of two parts. In the client side, our users are able to control the CVSS system. In the server side, Microsoft Hyper-V will create a Virtual Machine (VM). We deploy a program running environment in Hyper-V based on Windows Server 2012 R2. Finally, we export the Microsoft Windows server in a VM file to the private cloud (Bogardi-Meszoly et al., 2006).

With the development of cloud computing, the traditional Client/Server (C/S) architecture is difficult to meet the requirements such as visual information sharing, notification push, etc. Brower / Server (B/S) structure is based on HTTP as the transmission protocol in use of WWW technology, however cloud users access the powerful features via the SaaS while reducing the pressure of traffic jam in the client side. Our proposed CVSS system adopts the cloud-based architecture, the user access and system control are carried out by using the well-designed PaaS, SaaS, and IaaS (Tekeoglu & Tosun, 2015).