

New Approaches of Cloud Services Access using Tonido Cloud Server for Real-Time Applications

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ABSTRACT

A Tonido cloud server provides a private cloud storage solution and synchronizes customers and employees with the required cloud services over the enterprise. Generally, access to any cloud services by users is via the Internet connection, which can face some problems, and then users may encounter in accessing these services due to a weak Internet connection or heavy load sometimes especially with live video streaming applications overcloud. In this work, flexible and inexpensive proposed accessing methods are submitted and implemented concerning real-time applications that enable users to access cloud services locally and regionally. Practically, to simulate our network connection, we proposed to use the Raspberry-pi3 model B+ as a router wireless LAN (WLAN) that enables users to have the cloud services using different access approaches such as wireless and wireline connections. As a case study for a real-time application over the cloud server, it is suggested to do a live video streaming using an IP webcam and IVIDEON cloud where the streaming video can be accessed via the cloud server at any time with different users taking into account the proposed practical connections. Practical experiments showed and proved that accessing real-time applications of cloud services via wireline and wireless connections is improved by using Tonido cloud server's facilities.

Keywords: Cloud Services, Tonido Cloud Server, Video Streaming, Real-Time Application.

أساليب جديدة للوصول إلى الخدمات السحابية باستخدام خادم تونيدو السحابي في التطبيقات الآتية

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الخلاصة

يوفر خادم السحاب TONIDO حلاً للتخزين السحابي الخاص ومزامنة العملاء والموظفين مع الخدمات السحابية المطلوبة على المؤسسة. بشكل عام، يكون وصول المستخدمين إلى أي خدمات سحابية عبر اتصال الإنترنت، والذي قد يواجه بعض المشكلات مما يعيق المستخدمين من الوصول إلى هذه الخدمات بسبب ضعف الاتصال بالإنترنت أو الحمل الثقيل في بعض

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الأحيان وخاصةً مع تطبيقات بث الفيديو المباشر عبر السحابة. في هذا العمل، يتم تقديم وتنفيذ طرق الوصول المقترحة المرنة وغير المكلفة فيما يتعلق بالتطبيقات الأنية التي تمكن المستخدمين من الوصول إلى الخدمات السحابية محليًا وإقليميًا. من الناحية العملية، لمحاكاة اتصال شبكتنا، اقترحنا استخدام نموذج Raspberry-pi3 كشبكة LAN لاسلكية للموجه (WLAN) تمكن المستخدمين من الحصول على الخدمات السحابية باستخدام طرق الوصول المختلفة مثل الاتصالات اللاسلكية والاسلكية. كدراسة حالة لتطبيق في الوقت الفعلي على خادم سحابي، اقترحنا إجراء بث فيديو مباشر باستخدام كاميرا ويب IP و IVIDEON cloud حيث يمكن الوصول إلى الفيديو المتدفق عبر الخادم السحابي في أي وقت مع مستخدمين مختلفين مع مراعاة التطبيق العملي المقترح روابط. لقد أثبتت التجربة العملية أن الوصول إلى التطبيقات في الوقت الحقيقي للخدمات السحابية عبر اتصالات سلكية ولاسلكية يتم تحسينه باستخدام مرافق Tonido cloud server. الكلمات الرئيسية: الخدمات السحابية، خادم تونيدو السحابي، البث الفيديوي المباشر، تطبيقات الواقع الحالي

1. INTRODUCTION

Today, information technology plays an essential role, especially in the field of education. It has recently emerged in modern technology. It has significantly outpaced its spread, known as cloud computing, which is a computing service that needs the internet to access its services (Kadhim, 2014). Cloud computing enabled the delivery of a large number of services without the need for papers. This is a great leap in our current world (Sabi, 2016). This research paper shows relying on cloud computing services in many educational and academic institutions, by conducting many reviews on cases where cloud computing is beneficially used within institutions (Yadav, 2015) to meet many barriers and challenges. Cloud computing acts like an actual pattern shift in the direction that the programs are deployed, developed, and utilized. Cloud computing, based on service computing, has a notable contribution to investigating the long-term dream of computing tools in realizing the evaluation of non-scalable and globally available systems. With cloud computing, the employee and users able to begin sufficiently small and get large at a restricted speed only according to their needs, which means cloud computing is revolutionary even if the technology underlying an evolutionary process (Ibrahim, 2015, June).

Here a bunch of free software in open source cloud is found that aid and direct the end-users from configuring the file server to file mapping and synchronization. These utilities are combined in one software unit. The authors examined the various open-source programs presently obtainable on the internet and made comparisons between them. There is seven best open-source personal private cloud software to set up cloud storage ownCloud, Nextcloud, Seafile, Pydio, Tonido, Cozy, and Synthing (Anciaux, 2019). During the scanning on open-source cloud software, it was found that Tonido cloud software is wealthy in features that include all of the functionality usually wanted by any educational establishment (Naik, 2015). A Tonido cloud server is a very scalable, private cloud storage/synchronization solution, which is a program that enables the employee or user to provide private cloud storage solutions and synchronize customers, employees, and customers over the enterprise (Tian, 2011, April). The users access the Tonido cloud server through the mobile device or by another computer through two approaches Internet network and Intranet network. By using the Internet network where the users can access the cloud with the same networks where the server and users connect to the same network by using (IP address of network) and different network by using (DNS address) (Mahmoud, 2013) (Ab Rashid Dar, 2018).

Using the Internet network where the users can access the cloud with the same networks using the internal connection (the IP address of Tonido clouds such as 192.168.0.55:10001) where 10001 is the port of Tonido cloud, or from different networks using the external connection (DNS address of Tonido such as https://dmjs.TONIDOID.com). When the Internet service is unavailable, or there are disconnects, users whether (students or teachers) or employees in any academic company, cannot connect to the server except in the case of the return of the internet and this provides a loss of time and delays to implement the tasks of users. Therefore, new approaches will be suggested



to allow the users to access their files in the Tonido cloud by using an Intranet network using Raspberry Pi 3 Model B +.

The Raspberry Pi 3 Model B+ is the latest product in the Raspberry Pi 3 range, boasting a 64-bit quad-core processor running at 1.4GHz, dual-band 2.4GHz and 5GHz wireless LAN, Single Core @700 MHz, 512 MB SDRAM @ 400 MHz Bluetooth 4.2/BLE, 40 pin, faster Ethernet, and the dual-band wireless LAN comes with modular compliance certification, allowing the board to be designed into end products with significantly reduced wireless LAN compliance testing, improving both cost and time to market (He, 2018), as shown in Fig. 1.

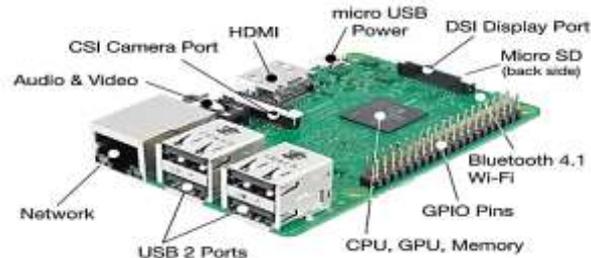


Figure 1. Raspberry Pi 3 Model B+ (He, 2018).

Raspberry was set as a wireless access point (router) in the local area only as an access technique that allows the users to access the Tonido cloud (Anon., n.d.). So, the users can access the Tonido cloud using the Intranet networks through both the internal connection (wireless cable) and external connection (Ethernet cable), where the Raspberry acts as a router with username and password.

Finally, as a case study, it is suggested to do a live video using IP webcam application on the mobile devices (Saha, 2018) (Xu, 2012, December) to display teaching lectures in front of students at the time when the teacher displays his lectures in another class to reduce the effort that the teacher exerts when delivering the same lecture in two different classes and to reduce the time for students and the teacher using the Internet network with the same network or different network using ivideon cloud streaming (He, 2015). Students face the problem of Internet disconnection, whether at home or the university, so they have a problem watching the live video that is broadcast in the same place or from another place. Therefore, it is suggested that students connect to the Intranet network explained in the previous sections to allow them to watch this broadcast either through the internal or external connection, to execute their tasks in the time.

The contribution of our work is the use of the Tonido cloud server to store all files, whether in education or academic institutions. Then, it is suggested to create an internal network using Raspberry due to weakness in Internet services. Finally, trending to make live video broadcasts, and access to it was made via the networks of the internet and the Intranet and stores the live video in the TONIDO cloud to see it any time.

2. TONIDO CLOUD SERVER

A Tonido cloud server is a program that allows users to remotely access, cloud-hosted, privately, and highly scalable. Tonido software makes files and media stored on the computer available remotely via the Internet or Intranet through any web browser or local mobile applications, once installed on any computer. The files stored on the computer include music and videos (Naik, 2015). Tonido permits various computing devices to sync files across the Tonido server, without using a public cloud. Synchronization utilizes Tonido servers. The company supplies 2 GB of simultaneous storage for free, and 100 GB for professional users. Tonido is obtainable as binary



packages for public Linux distributions like Fedora, Ubuntu, OpenSUSE, Mac OS X, and windows. Tonido sells a tiny, minimal-price computer that turns on Tonido (Tian, 2011, April).

2.1 The Characteristics of Tonido Cloud

The core files are accessed wherever they are. The files are easily synced with other users. Sharing files is with other users; outside and inside the collection, control, and security and of the intellectual property, The price is free, Tonido Cloud is scalable from 10s to millions of users, mobile access.

2.2 Installing Procedure of Tonido Cloud Server

- **Step 1.** Opening a web browser on the internet and searching for `http://127.0.0.1:10001` and installing the Tonido software on the computer
- **Step 2.** Displaying the remote access server URL for the TONIDO account (in the shape of USERNAME.TONIDOID.com, where the USERNAME is the name that is chosen when creating the account in the first step).
- **Step 3.** Clicking next, the Tonido account final settings window is shown.
- **Step 4.** After completing the installation process of Tonido, the address of Tonido is written with any browser, as shown in **Fig. 2.**



Figure 2. Login to Tonido account.

2.3 The Functions of Tonido cloud

- Creating guest users
- Download/Upload files
- Sharing using Email and WebDAV protocol. The WebDAV protocol can be defined as an expansion of Hypertext Transfer Protocol (HTTP) that enables the implementation of remote operations for the creation of content on the web. The WebDAV protocol is classified as readable and tangible on the web.
- Monitoring cloud activity
- Installing mobile Tonido application

3. CLOUD SERVICES ACCESS

The users access the cloud server through the mobile device or by another computer through two techniques: Internet network and Intranet network.

3.1 Cloud Services Access by Internet

By using the internet, users can access Tonido cloud services via internal and external connections. The internet allows users to access the cloud from the same places by using IP addresses of the Tonido server (internal connection) or from different places using the DNS address of Tonido



(external connection). So, the users can access the cloud from the same network or different networks.

3.1.1 Cloud Services Access by Internal Users

1. Firstly, connecting the server's computer to any Internet network and taking the computer's IP address such as 192.168.0.107.
2. The users need to access the Tonido cloud are connecting to the same network in which the server is connected through it.
3. On any browser, type the IP address of the Tonido server with its webserver port (10001) such as 192.168.0.107:10001 in this way, the users can access the Tonido cloud.
4. This method is only intended for users found in the same place, and they connect to the same network that the server is connected to, they can access the cloud through IP address, but if the users connect to networks that are different from that server network. Therefore, we explain another method to access the cloud.

3.1.2 Cloud Services Access by External Users

1. In step one we repeat the first step of the previous method which is used to access the cloud by internal users. We suppose the IP address of the Tonido server is 192.168.0.107 while the users are connecting to the network that IP address is 192.168.1.110. The Tonido cloud server takes the IP address of the computer automatically.
2. We cannot access the cloud with the IP address of the Tonido server, but the most successful way is with the DNS address of the Tonido cloud, such as <https://fdfg.TONIDOID.com>.
3. Thus, users can easily access their files stored inside the cloud through the internet and from various networks.

3.2 Cloud Services Access by Intranet

An intranet is a means of communication in a locked society. With an Intranet, messages are transmitted via a gateway, using the firewall to permit users to send legal and encrypted messages, so that they cannot be seen by anyone else who does not belong to the users within the organization. An Intranet network is limited to a specific group of users. An example would be a network that only the employees of a particular company can access. So, in this work, an Intranet network is made as an access technique that allows the users to access the Tonido cloud. It was proposed to use the Raspberry Pi 3 Model B+ as a wireless LAN access point (WLAN). Firstly, Raspberry Pi was set up as a WLAN router (WLAN access point). WLAN router provides (WLANs) with their own IP configuration to several (WLAN) clients via its integrated access point. The WLAN router has a DHCP and DNS server for this purpose. An alternative for this WLAN access point is a WLAN bridge. Here, the Raspberry Pi serves only as a network bridge for two network segments. On one side, the WLAN and on the other side, the wired network.

• The Hardware Requirements:

The following components will be needed to set up raspberry pi as a wireless access point [10]:

1. A raspberry pi model A/B/B+, in our work we used raspberry pi model B+.
2. A good quality micro USB power supply that can provide at least 700mA at 5v. In our work, we used (5 dc volt at 2 Amp).
3. 4 GB class 4 SD card, in our work we used (32 GB SD card).
4. An Ethernet cable.
5. USB keyboard and mouse.



6. HDMI video cable to connect with HDMI cable monitor /TV or HDMI to VGA connector to connect with VGA capable monitor. The hardware requirement is shown in **Fig. 3**.



Figure 3. The Hardware requirement.

- **The Software Requirements:**

The latest version of Raspbian (Raspbian image 2019) was downloaded, and the image file was unzipped. SD card was formatted using SD card formatter software. The bootable image for Raspbian OS was made using win 32 disk imager software. The bootable memory card was inserted into Raspberry Pi. All devices (USB keyboard and mouse, Ethernet cable, HDMI cable, power supply i.e charger) were connected, and the switch button was powered on.

3.2.1 Cloud Services Access by Internal Users

Firstly, the computer that has the Tonido cloud as a server on it was connected to the internal network of the Raspberry through making a wireless connection and taking the IP address of this computer. Then the IP address of this server with the port of the Tonido cloud (10001) such as 192.168.1.100:10001 was written at any browser on the mobile devices (client) or another computer. In this case, both the computer (server) and the client (users) should connect to the same network of internal.

1. The IP address of the Internal network (wireless) is 192.168.1.1.
2. The Tonido server is connected to the network of Raspberry, which has the IP address 192.168.1.110. Then 192.168.1.110:10001 was written on any browser where the Tonido cloud is opened.

3.2.2 Cloud Services Access by External Users

Firstly, an Ethernet cable was connected between the Tonido server and Raspberry Pi, where the IP address of the Ethernet connection of Raspberry is 10.0.0.1.

1. In this way, the server is connected to the internal network with IP address 10.0.0.2.



- Then, the users connect to the internal Raspberry network via wireless to the Raspberry network with (SSID = TONIDO) and password (TONIDO2020) with the different IP address such as 192.168.1.106.
- So, the users (human or robot) can access the cloud by writing the IP address of the server on any browser by writing 10.0.0.2:10001. In **Table 1.**, the difference between the two techniques that are used to access the cloud according to the speed meter for downloading and uploading test is shown.

Table 1. The speed meter of different networks methods.

The Access Method	Speed Meter
Using the Internet network(Internal connection)	1.5 MB/S
Using the Internet network (External connection)	518KB/S
Using an Intranet network (wireless access method)	1.69MB/S
Using an Intranet network (wire access method)	2.65MB/S

From **Table 1.**, it is concluded that the speed meter of the intranet network in the case of downloading and uploading files from the Tonido cloud is faster than the speed meter of the internet network, especially when using an Ethernet cable where the download speed increased to 65MB / S.

4. REAL-TIME CLOUD APPLICATION

It was suggested doing live video streaming to display teaching lectures in front of students at the time when the teacher displays his lectures in another class. Thus reducing the effort that the teacher exerts when giving the same lecture in two different classes and to reduce the time for students and the teacher. Initially, the suggestion was to use a robot to do this work, but for lack of a robot, it was suggested using the mobile as an example of a mobile robot. The procedure of the real cloud services (live video) is shown in **Fig. 4.**

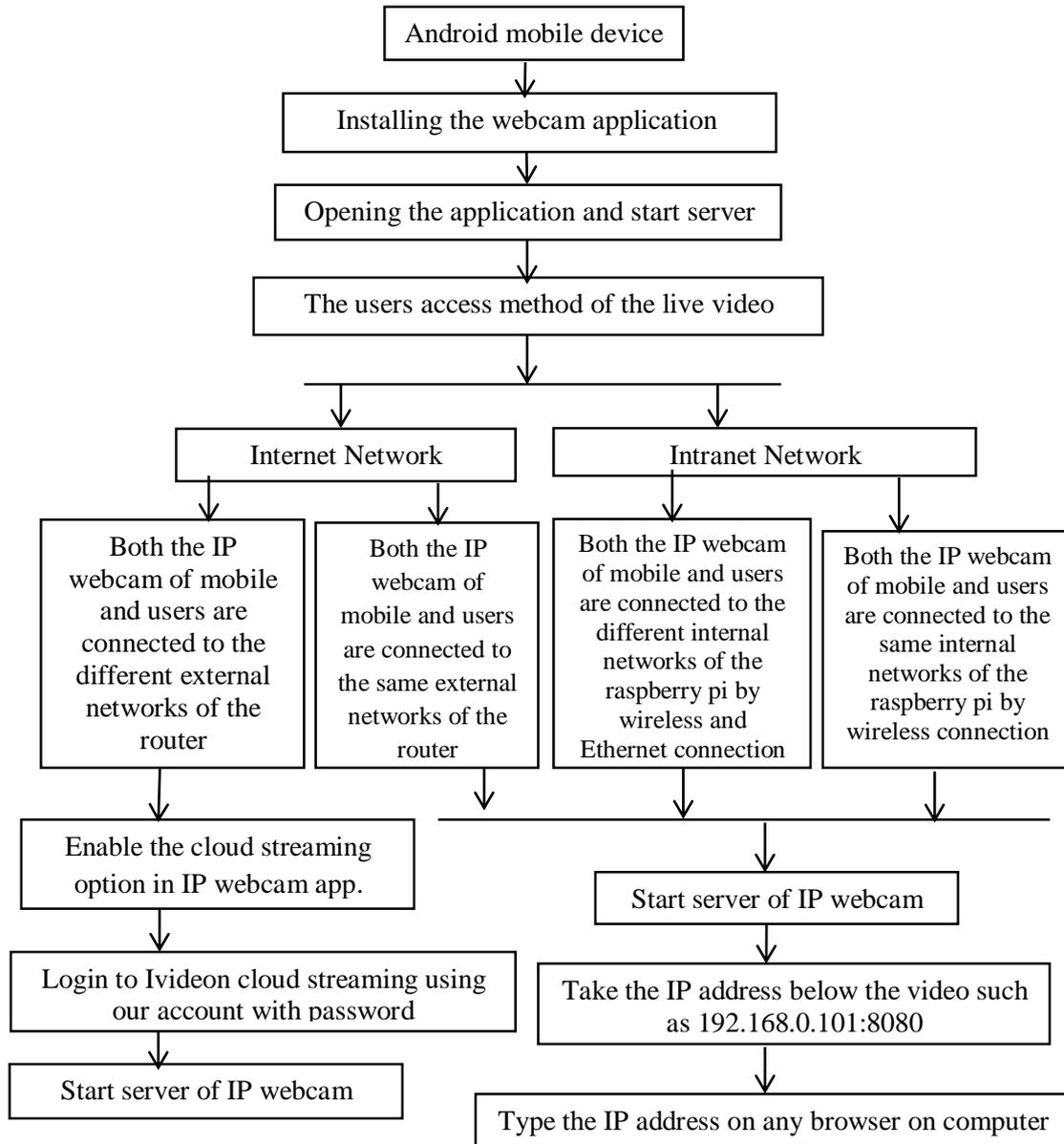


Figure 4. The conceptual diagram of live video.

There is an application called IP webcam camera that can be found on the play store. This application was installed, and then the phone was put in some strategic position around the room that the teacher displayed his lectures where everything needed could be seen. Starting it up then, everyone can connect to it from the internet wherever. The real-time checked in what is going on in the class or house. Real video and audio will be seen, as well as the trend to explain all the most important settings of this application in the following sections. On the play store, an application (IP webcam) was looked for. The server was started by clicking on it.

4.1 Live Video Streaming Access by Internet

Live stream refers to the recorded online broadcast media and broadcast simultaneously in real-time. It is often referred to simply as a stream. Still, the abbreviated term is ambiguous because "streaming" may refer to any media being delivered and played simultaneously without requiring



a fully downloaded file. Non-live media such as video on demand, blogs, and YouTube videos are streamed technically but are not streamed live. Online video internet video is the public domain that deals with online video transmission. Internet video is available in several formats, most notably MPEG-4 AVC, MP4, FLV, and AVCHD. There are several services of online video hosting, including YouTube, Vimeo, Twitch, and Youku.

4.1.1 Live Video Streaming Access by Internal Users

The IP webcam was allowed to use the camera to record audio and to read, to access files, as shown in **Fig. 5**. The camera is to make a live video. Also, the IP address 192.168.0.101 with its port 8080 could be seen, this is the address of IP webcam

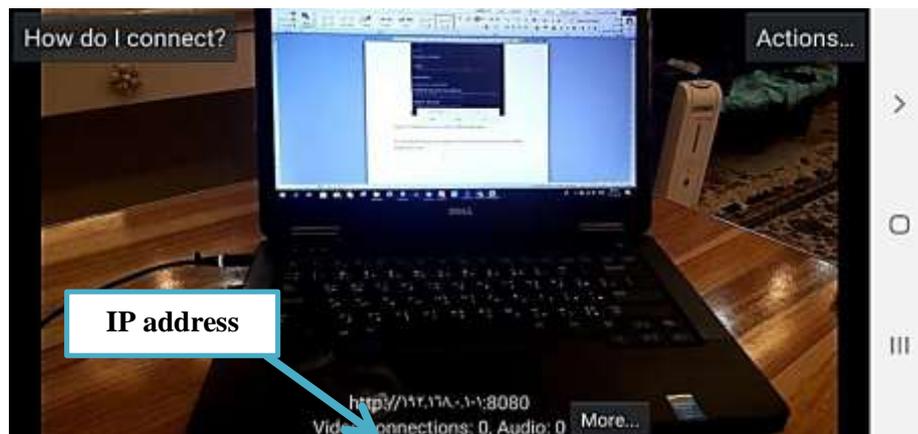


Figure 5. The live video by IP webcam using the internet.

Now typing on the computer, by opening the browser, and typing the IP address that seen on the application on the phone and press enter, and the page of the IP webcam will be seen. If everything is correct, this page could be seen as in **Fig. 6**. Now going straight to see the video, by going on the browser on the internet, and this is the computer where recording is started right now.

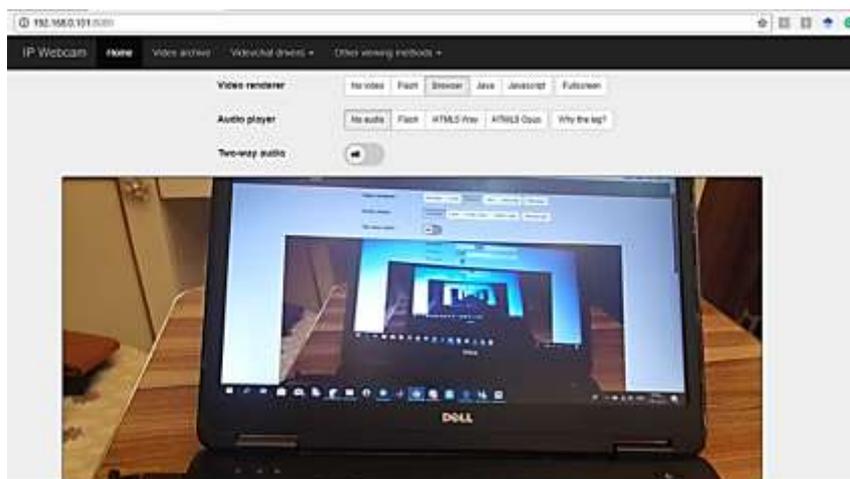


Figure 6. live video streaming on a computer on the internet.



4.1.2 Live Video Streaming Access by External Users

To stream the video online and from anywhere, where the users are connecting to the different networks through the router, the application IVD (ivideon. Video surveillance) should be used. **Fig. 7** shows the installing of the ivideon app on (PC, MAC, Android, iPhone), which is available in the IP webcam application.

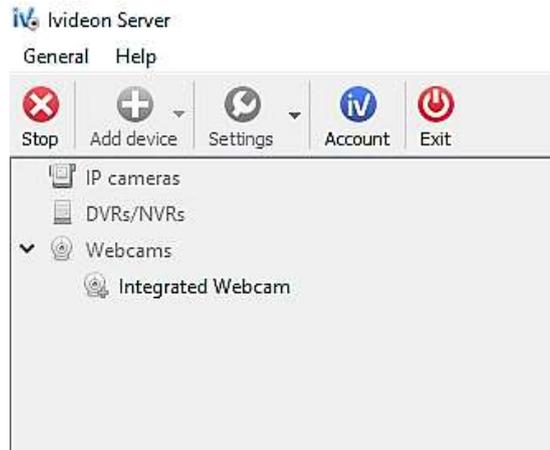


Figure 7. Installing application ivideon on PC.

Another way is to register on this website at ivideon.com, and make an account then sign up with the email address and password. Then selection it for business or home. Once the account is completed, turning to the main page of the IP webcam application until the voice connection setting, and then choosing cloud streaming. Going now on a video account, logging in by inserting the email and password of ivideon cloud and pressing login.

Now, after successfully logging in, then going back as before, then at the bottom pressing the start server of webcam. It is as before, but one difference, there is not only the IP address but also an HTTP address such as <http://ivideon.com/my>, as shown in **Fig. 8**. That means streaming this video with a different network using ivideon.

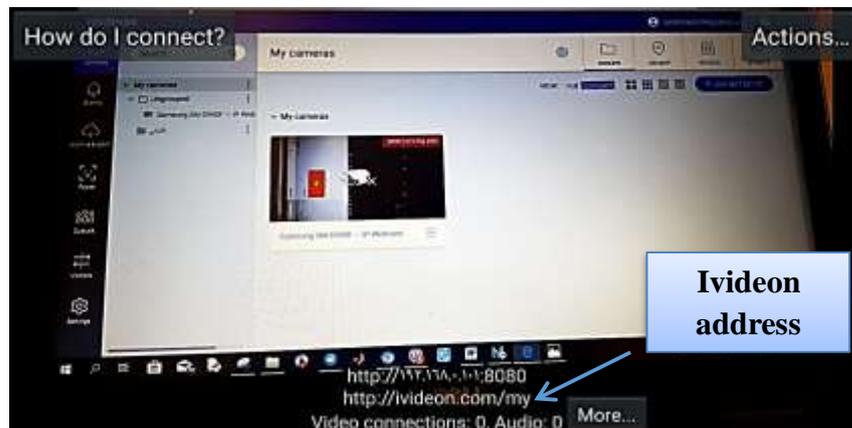


Figure 8. Start the Live video streaming by the camera.



- Going back to the computer on the website or application, going to log in with the account as shown in **Fig. 9**, and here live video streaming from different networks is seen.

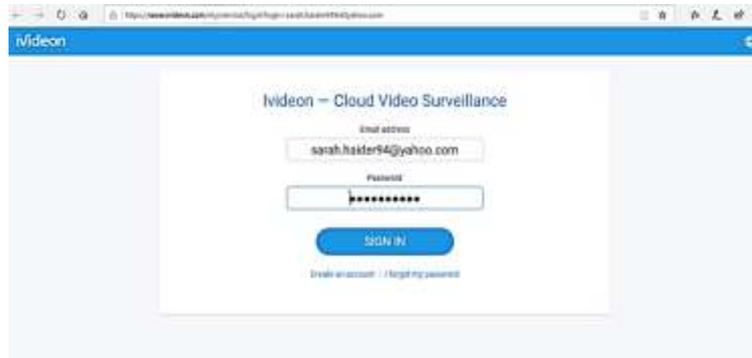


Figure 9. Ivideon cloud account.

It can be connected to different cameras from different networks. Also, the different cameras could be connected with a cloud. Then, different users can access this live video from the different networks by typing the email address and password of this cloud. **Fig. 10** shows the live video by IP webcam that can be accessed from different places by just going on the link of the camera, and the streaming live time will be seen from the phone, there is some delay. It is not quick as before; there are around 10 seconds of the delay.

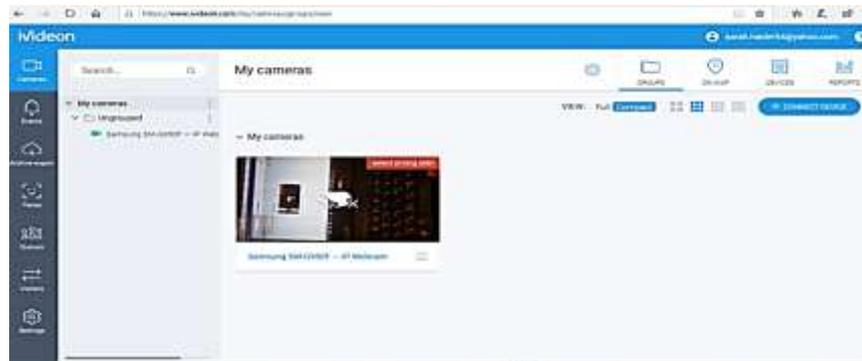


Figure 10. Live video streaming by the IP webcam.

It was proposed to save the live video streaming in the (video archive) option, as shown in **Fig. 11** and then store these videos on the Tonido cloud to view it by another user that cannot connect to the ivideon account because they don't connect to the external network through the router. Still, they have only an internal network so they can reach the video by accessing the Tonido cloud through the Intranet network by using the Raspberry pi.

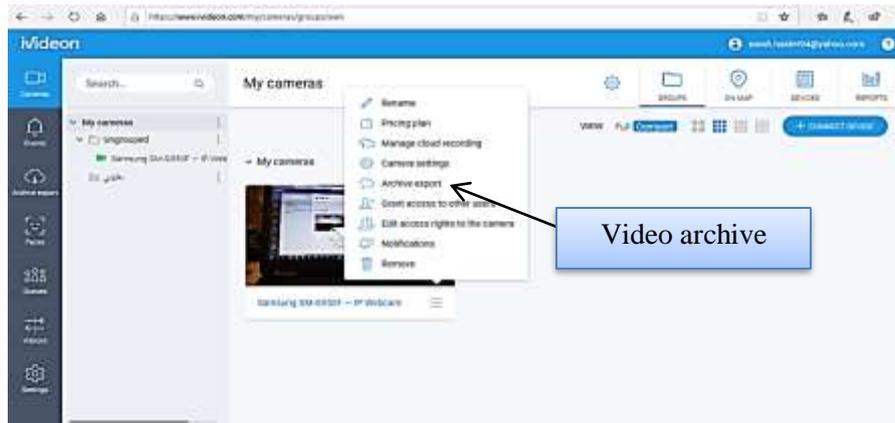


Figure 11. The video archive option in ivideon cloud.

So, **Fig. 12** shows the different streaming videos saved in the Tonido cloud. So, the number of users can view these videos from the different networks where the video is saved on the Tonido cloud.

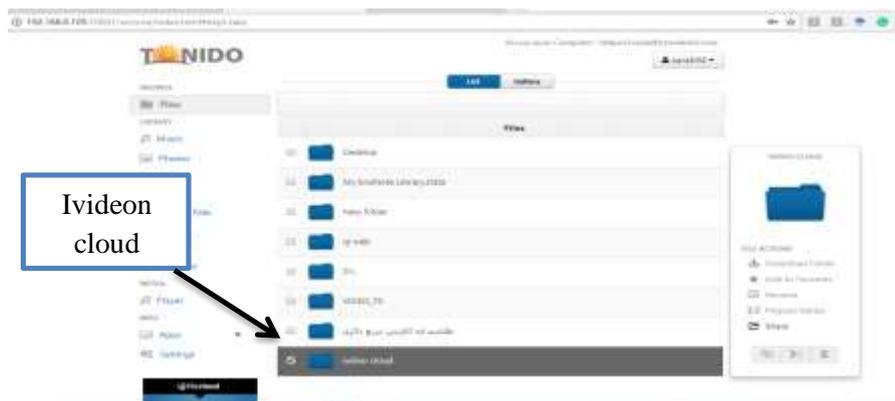


Figure 12. The videos of ivideon cloud stored in the TONIDO cloud.

Keeping in mind that now the webcam is only using their internal and external connection when both the computers and the phone are connected to the Intranet through the router.

4.2 Live Video Streaming Access by Intranet Network

Students face the problem of Internet disconnection, whether at home or the university, so they have a problem watching the live video broadcasted in the same place or from another place. Therefore, it was suggested that students connect to the Intranet network explained in the previous sections to allow students to watch this broadcast either through the internal or external connection, to execute their tasks in the time.

4.2.1 Live Video Streaming Access by Wireless Connection

The users can access the live video using the Intranet network with a wireless connection through Raspberry Pi. Both computers of users and the camera are connected to the same network of



Raspberry with (SSID: named by TONIDO with IP address 192.168.1.1). **Fig. 13** shows IP address below the video 192.168.1.123:8080 from the mobile.



Figure 13. The live video streaming access through a wireless connection of the Intranet network.

The computer was connected to the same Raspberry network that the phone connected to it. Then, typing the IP address on the computer by opening the browser and typing the IP address seen on the application on the phone and pressing enter, and the page of the IP webcam is seen, **Fig. 14**.

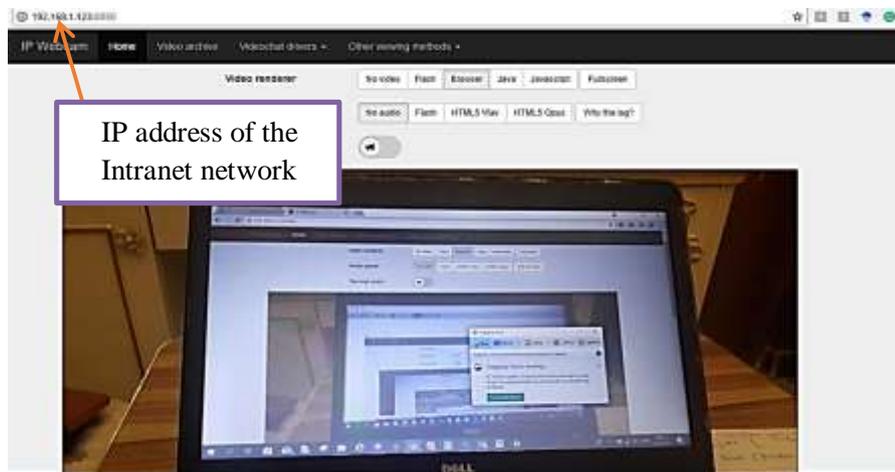


Figure 14. The IP address of the Intranet network of the Raspberry Pi.

The IP webcam application provides options to record the live video recorded by the camera of the mobile also provides an option to take photos. Therefore, it is suggested to save these recorded videos inside the Tonido cloud. In the first step, this video is recorded with a video recorder. Going to the option to save the videos (video archive), as shown in **Fig. 15**, it can be seen all the recorded and stored videos. They are stored in the Tonido cloud to allow a number of users to view these videos at a later time through the internal or external connection of the Intranet network, where Tonido cloud provides the option to save the videos and images.

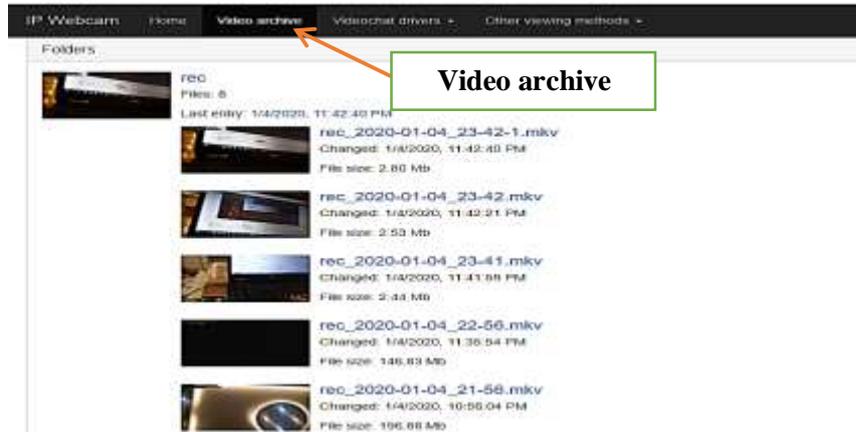


Figure 15. Video archive option.

Therefore, users (human or robot) can access the video stream that is stored on the Tonido cloud using their account via the internal network, as shown in Fig. 16. These videos could be used by students, especially if lectures were educational and beneficial for students who cannot reach the class for some reason. These videos facilitate many tasks for students.



Figure 16. The video stream stored on the Tonido cloud.

4.2.2 Live Video Streaming Access by Wire Connection

After that, the computer connected to any Internet network cut off. The Ethernet cable between the computer and the Raspberry is connected so that the computer is connected to the Raspberry network via Ethernet, where the IP address of Ethernet connection is 10.0.0.1, while the IP address of the wireless connection of the mobile that has the IP webcam application on it is 192.168.1.1. In this case, both the mobile and users are connected to different networks by using the Raspberry (Intranet network), as shown in Fig. 17, where the mobile that carries the IP webcam application is connected to the Raspberry network with wireless. Again, a live video is done via the IP webcam and take the IP address below the video on the mobile.

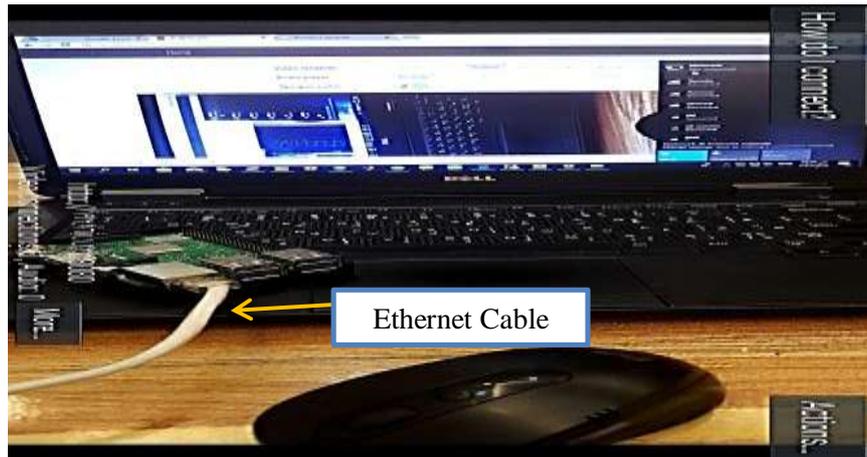


Figure 17. The live video streaming access through wire connection of the Intranet network.

Again typing the IP address on the below of the video on any browser of computer and watch the live video recorded by the camera of the mobile. These videos are recorded to save it in video archives to allow the different users to access these videos through the Tonido cloud, as shown in Fig. 18, where the Tonido cloud can also access through the external or internal connection of the Intranet network. To open the Tonido cloud is by writing the 10.0.0.2:10001 on any browser when the users are connected through the Ethernet network.



Figure 18. The live videos recorded by IP Webcam stored in the Tonido cloud.

5. CONCLUSIONS

It is concluded that the Tonido cloud is rich in features that are requested by any educational and academic institution. By Tonido, it is able to upload and download all types of files, whether educational files, pictures, or videos. Also, a number of guests were added where the Tonido cloud server gives authority to those responsible for a cloud account in determining the powers of users. Also, it is able to make file-sharing using email and WebDav protocol. Besides, Tonido provides monitoring of the access times of all users to TONIDO Cloud, thus providing greater privacy. Users access these services via the internet, but due to the weak internet and the possibility of its interruption, an internal network was created using the Raspberry to allow users to access the cloud through internal communication. Finally, a live video streaming access is made using IP webcam



where the users can access it through the internal and external connection and then stored inside Tonido to allow users to view it at another time.

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