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TECHNOLOGY INFORMATION SYSTEM, EMERGING NETWORK TECHNOLOGIES

APPLICATION OF 5G IN SMART CAMPUS

"EMERGING TECHNOLOGY ON NETWORK INFRASTRUCTURE" (COMMSCOPE MALAYSIA)

INDUSTRIAL TALK 5 [29 NOV 2021]
BY MR GOH BIH DER

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WHAT IS 5G ON SMART CAMPUS?

For several years, most corporate industries have been undergoing digitalization efforts. Businesses all over the world have been preparing for their digital transformation by using new ICT and IoT technologies to improve their operational operations on a variety of levels.

This is also true in the field of research and education, where universities play a key role in pointing the way ahead. Campuses with ICT, cellular network technology, and software research divisions, in particular, are likely to be at the forefront of developing and implementing advanced educational and research settings. Data acquired from specific environments by sensors, gadgets, machines, vehicles, and persons is becoming increasingly important in the development of new services and applications on campuses.

Society strives to simplify critical activities and offer innovative services for its citizens through digitization. 5G wireless networks are being created all over the world, and there are high expectations for them. The technology is expected to help the most various verticals in the initial phase of 5G, such as factories, hospitals, and campuses. But in this article let's focus on campus. Smart Campus can provide advanced services and personalized information to students, professors, researchers, and visitors.

In addition, the students want to understand how to operate in a digital environment. This is a problem that many Smart Campus projects are attempting to address. Students nowadays have great expectations for their schooling. Listening, writing, exercising, and exhibiting in a classroom are no longer the exclusive methods of teaching. Technological advancements have been readily seen in educational settings, raising questions regarding the advantages of technology-enhanced learning. Students are increasingly expecting a high-quality learning environment, both technically and in terms of content. They also have the option of choosing when and where they learn.

APPLICATION OF 5G IN SMART CAMPUS

A virtual reality environment, in which students may walk into a virtual working environment and supervise part of the manufacturing gear and systems remotely, is a frequent use case today. For medical students, demonstrations of how to use 5G technology and mixed reality technologies in a hospital operating room and at a distant location were given. As a result, in addition to instruction on a physical campus, colleges may use technology to lure students to engage in distant classes from anywhere in the world. Today, we are on the verge of providing students with high-quality immersive learning environments.

A medical university, for example, would invest in an instructional operating room with high-resolution cameras, mixed reality goggles, and high-speed wireless networks.

VR in medical education provides a safe environment in which students may receive interesting, engaging, interactive, and cost-effective experiences. These situation-based experiences, particularly surgical experiences created by VR technology and presented to students, allow them to practice doing surgery to gain information and skills without risking their lives. When it comes to the promise and potential of VR in medical education, there is a scarcity of study. It's critical to expand existing understanding and research variety in this area. As a result, the study's goal is to look into students' reactions to the usage of virtual reality in healthcare education.

Several studies have proven that simulation training is an excellent way to develop knowledge and abilities in healthcare education.

Virtual reality training allows healthcare providers to teach medical students by removing any dangers that might lead to a negative patient outcome. VR technology is not only seen as a cost-effective learning approach to repeatedly practice several simulated clinical scenarios in healthcare, but it is also seen as an interactive and effective experiential learning for medical students to develop skill and confidence needed when they encounter in a real-life situation. As a result, the use of virtual reality allows medical students to practice without fear of making mistakes or incurring serious consequences, and to be prepared to recognize illness signs and even perform complex surgeries.

For instance, the capabilities of VR devices allow individuals to practice simulations in the form of VR whenever and wherever they choose, as well as evaluate their work after completing practices by saving and replaying.

Furthermore, the usage of virtual reality technology reduces anxiety and boredom in the classroom, making the learning process more interesting and effective. Students in all fields of dentistry benefit from the rapid technology advancements in VR, which give more effective and efficient realistic pre-clinical dental experiences.

“Healthcare is one of the most exciting fields when we think about 5G’s ability to not only transform an industry but also literally improve lives,”

- John Saw, executive vice president of advanced and emerging technologies at T-Mobile

REFLECTION

Digitalization is a worldwide movement that poses problems to all levels of society. To compete in the global marketplace, every institution, from governments to small businesses, must plan and develop a digitization agenda. ICT and IoT technologies are viewed as critical to this evolution's success. Sensor technologies, 5G and IoT networks, as well as computation and data analytics using MEC and cloud computing technologies, are all important in the creation of revolutionary applications and services for the university society.

Many colleges are eager to put up a Smart Campus environment. The network is frequently utilized for the development of unique 5G services for verticals such as health care, education, industry campus, and traffic. The change is more than a one-time event; the additional technological infrastructure necessitates deciding how to maintain and run complex systems to maximized their value.

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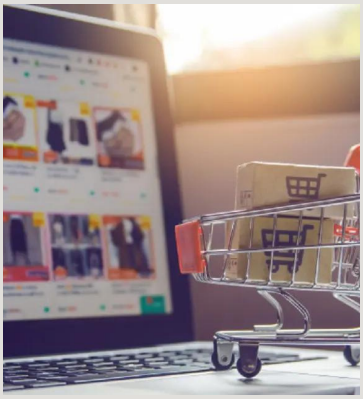


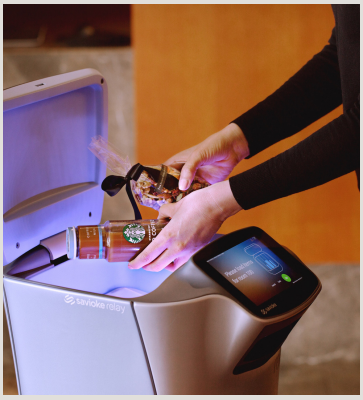
PANDEMIC IMPACT TO IT WORLD

The coronavirus (COVID-19) outbreak is causing widespread concern and economic hardship for consumers, businesses and communities across the globe.

Companies are leaning towards remote working environments which allows professionals to work outside of a traditional office environment.

The pandemic has also changed the way consumers use e-commerce and digital solutions to which consumers now shop online more frequently and rely on the internet more for news, health-related information and digital entertainment.

Acceleration of digital transformation come about among organizations where the process of using digital technologies to create new — or modify existing — business processes, culture, and customer experiences to meet changing business and market requirements.



Internet connectivity improved with higher speed broadband and further wi-fi enhancement by the government for organization and consumers' use. IT infrastructure also provides remote management to those who are interested in network usage.

POST PANDEMIC

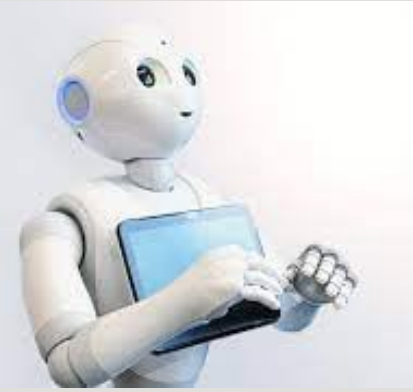
Hotels face rapidly changing guest behaviors, preferences, and expectations. The technology being developed for hotels post-pandemic is exciting and game-changing where hospitality improved guest services in which usage of IoT equipment are implemented in hotels. For example, hotel staffs are being replaced by robots in serving customers' orders.

In terms of security, IT security prevents unauthorized access to organizational assets such as computers, networks, and data. It maintains the integrity and confidentiality of sensitive information, blocking the access of sophisticated hackers. This results in consumers being more inclined to opt for IT security to ensure their safety.

Furthermore, the rise in IoT device productions causes heated competition among brands to be the best developers for business purposes. It has become an increasingly complex challenge as billions of IoT devices are being deployed every month.

NETWORK INFRASTRUCTURE

The Wi-Fi — e.g.: Unifi — is a wireless technology used to connect computers, tablets, smartphones and other devices to the internet in which students and staffs represent the end-users. Universities utilizes IoT devices with set up personalized IoT and wireless protocols for end-users' usage to connect to the Internet. In computer networking, a wireless access point (WAP), or more generally just access point (AP), is a networking hardware device that allows other Wi-Fi devices to connect to a wired network. It has one cable connected to the switches — connecting it to desktops, printers, phones, smart TVs and others — The switches also posses a cable called an uplink, connected to the core switch. A data center is compromised by these components provide access to the internet. It is a facility that centralizes an organization’s shared IT operations and equipment for the purposes of storing, processing, and disseminating data and applications. With the number of faculties multiplied in modern universities, each faculty now has an access point for the devices to be connected.



ABOUT THE WI-FI AND THE ACCESS POINT (WIRELESS)

The global value of the Wi-Fi is 3.3 trillion USD and it is expected that the cost will increase up to 4.9 trillion USD by the year 2025. Wi-Fi 6 is the most recent iteration of the Wi-Fi network protocol and is a substantial upgrade over its predecessor. Malaysia will be opting for Wi-Fi 6E for the upcoming year. This new protocol is also more secure, uses new encryption and technologies enabled devices can take advantage of the newer 6GHz frequency band for further improved connectivity. In terms of MU-MIMO, it improves the upload and download rates. The access point helps to communicate with multiple wireless devices at once. This Wi-Fi 6/6E feature increases device sleep time and greatly improves battery life the smart lock even uses batteries. 1024-QAM technology allows each symbol — the amount of data in a burst of transmission — to carry 10 bits rather than 8 bits. Similarly to OFDM, it has developed into a popular scheme for wideband digital communication, used in applications such as digital television and audio broadcasting, DSL internet access, wireless networks, power line networks, and 4G/5G mobile communications. In terms of BSS coloring, the access point will be able to increase the Wi-Fi's performance to prevent interfering and overlapping.

MULTIGIGABIT TECHNOLOGY

With the enormous growth of 802.11ac and new wireless applications, wireless devices are driving the demand for more network bandwidth. The new Cisco Catalyst Ethernet Access Switches include Cisco Catalyst Multigigabit Technology, a unique Cisco invention. It allows you to achieve bandwidth between speeds of 1 and 10 Gbps over traditional Cat 5e cabling or above. Wireless devices are driving the demand for increased network capacity, thanks to the massive expansion of 802.11ac and new wireless applications. As the industry moves toward 802.11ac Wave 2, access points will require higher wireless bandwidth than 1 Gbps. Over standards of Cat 5e or higher cables, Cisco multigigabit technology allows you to reach bandwidths between 1 and 10 Gbps. In addition, certain Cisco Catalyst switches include multigigabit ports that enables Universal Power Over Ethernet (UPOE), has become increasingly critical for the next-generation workplaces and IoT ecosystems.

UNIFIED NETWORK MANAGEMENT

A unified network management product should make common network functions manageable from a single console. The console must also include elements that are unique to wireless management, such as connection reliability, spectrum management and monitoring, location and tracking functionality, and additional security concerns. It integrates wired and wireless components, which share network elements and services where feasible, rather than existing as two separate networks. In campus, the controller manages the entire network in a single platform rather than controlling more than 2000 networks previously.

INTERNETS OF THINGS (IOT)

IoT devices brings a lot of benefits especially in cost reduction. It helps to improve customer experience, for example using robot services to deliver customers' orders to their room. It also has lots of challenges especially in terms of security.

Despite the challenges, solutions are found. This brings advantages to the campus, for instance, the vape detector system enables the administrator to be alerted for students vaping on restricted grounds.

REFLECTION

There are thousands of students complaining about being unable to have access to the internet and often experience connectivity issues. Consequently, administrator require more recourses to handle the problem. Nevertheless, with the invention of analytic technology, we don’t need to spend so much time to solved this because the analytics will help us to show what is the problem and help with everything to solve the issue. This will be automated to solve the problem.

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5G

5G is the next and fifth generation of wireless technology systems.

It provides speeds faster than any previous generation -- comparable to those delivered via fiber-optic cables.

Early testing on this technology shows real-world speeds of 700-3025 Mbps (3.025 Gbps) -- which consumers may experience once 5G becomes comercially available. Movies that took minutes to download with 4G will take seconds with 5G.

The International Telecommunication Union (ITU) has decided to call the next generation cellular system IMT-2020, which follows in the footsteps of IMT-2000 (3G) and IMT-Advanced (4G).

Major 5G application scenarios include enhanced mobile broadband, massive machine type communications, and ultra-reliable and low-latency communications.

5G top potential industrial application includes 5G Smart Education, 5G Petro Station, 5G Smart Transportation, 5G Live Broadcast, 5G Public Safety, and many more.

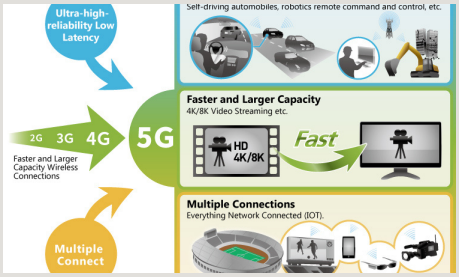
APPLICATION OF 5G

Virtual Reality (VR) will be one of the applications of 5G.

VR needs 5G because of its high throughput screening for retina experience and also its low latency to avoid motion sickness.

It provides 5037X5707 resolution for retina experience per eye and 6 angles for full-view panaromic video mosaics.

5G also offers an extremely low latency rate -- the delay between the sending and receiving information. It goes down to less than 20 ms with 5G.



5G FUTURE USE CASES

Examples of 5G use cases include augmented reality, virtual reality, driver information, entertainment in the vehicle, automation in the vehicle, smart grid, and delivery drone.

TRANSFORMATION ON INDUSTRY

Once 5G becomes widespread, the effect on industries could be transformative for 3 main reasons -- 5G devices has lower latency, thus enabling faster transmission of larger data streams.

5G devices are also more reliable -- it enables better transmission of data in extreme conditions.

Other than that, 5G is more flexible than Wi-Fi and can support a wider range of devices, sensors, and wearables.

WI-FI 6

Wi-Fi 6 is the next generation of Wi-Fi and it has been verified for more than 3 years. In October 2018, the Wi-Fi Alliance specified a new name for different Wi-Fi standards. 802.11ax was named Wi-Fi 6, which is a revolutionary new technology. Wi-Fi 6 supports "a broader range of devices and applications, from those requiring peak performance in demanding enterprise environments to those requiring low power and low latency in smart homes or industrial IoT scenarios," according to the Wi-Fi Alliance. It is an evolutionary step forward, with approximately four times the capacity of [802.11ac]. [Wi-Fi 6] provides vital connectivity for cellular networks, and it takes use of high speeds, low latency, power efficiency, increased capacity, and improved coverage to deliver a variety of advanced 5G services." In conclusion, Wi-Fi 6 enables a single wireless router to serve more devices. It also incorporates the WPA3 security protocol, which is required for open wireless access points and provides better encryption and improved privacy. Wi-Fi 6 helps protect your data while providing a better experience across a variety of devices.

ADVANTAGES OF WIFI 6

Wi-Fi 6 routers hire numerous new technology which are designed to reinforce typical overall performance via way of means of supplying multiplied throughput speeds (nearing 10Gbps, theoretically, in comparison with max speeds of round 3.5Gbps for 802.11ac).

In addition, Wi-Fi 6 targets to alleviate community congestion, offer more patron ability, and decrease patron strength consumption. For example, Wi-Fi 6 makes use of Orthogonal Frequency-Division Multiple Access (OFDMA) modulation, which permits as much as 30 customers to proportion a channel on the equal time, thereby enhancing performance via way of means of boosting typical ability even as decreasing latency. Long tale short, OFDMA assigns time durations to customers that permits them to higher parse out to be had community channels. For example, if one man or woman in your house is streaming a film and every other is checking social media on a phone, OFDMA permits a router to assign channels to every tool primarily based totally on whilst it wishes it most.

Wi-Fi 6 additionally makes use of Target Wake Time (TWT), which permits gadgets to decide whilst they'll generally awaken to start sending and receiving statistics. This extends the battery lifestyles of cellular gadgets which include smartphones and tablets, in addition to battery-powered clever domestic gadgets which include protection cameras and video doorbells. The new popular additionally takes gain of formerly unused radio frequencies to offer quicker 2.4GHz overall performance, and it makes use of delicate bandwidth control to offer better Quality of Service (QoS) options.

DEVICES THAT SUPPORT WIFI 6

- Apple M1 MacBook Air, M1 MacBook Pro
- Asus Chromebook Flip c436
- Dell XPS 13 (2020)
- HP Spectre x360
- Lenovo Yoga c940
- Microsoft Surface Laptop Go
- **Lenovo -** Legion Pro, Legion Duel
- **Samsung -** Galaxy Fold, Galaxy Fold 2, Galaxy Note 10 series, Galaxy Note 20 series, Galaxy S10 series, Galaxy S20 series, Galaxy Z Flip 5G
- **Huawei -** P40 series

REFLECTION

In conclusion, 5G and WiFi 6 will foster new possibilities and benefits. For Wifi 6 it's going to boom get entry to factor capability in aid of IoT and mobile gadgets , extra channel width which will let you mixture 160 Mhz channels, extra green bandwidth sharing brings efficiencies to the gadgets at the network, ensuing in higher speeds additionally a brand new capabilities that is placed sure device's WiFi to "sleep" whilst it's now no longer getting used and lastly, the get entry to factors of WiFi 6 that helping it are backward compatible. While for 5G, it is able to boom down load pace via way of means of up to 20 times. It may also the opportunity of getting a hyper-interconnected surroundings to attain the factor of getting the a good deal desired "smart cities". Last but not least, 5G predicted to revolutionize regions together with medicine (far off operations, for example), and site visitors control and self reliant vehicles, in addition to its implementation withinside the creation region to optimize sources and decrease risks.