SECP 1513 - Sec 07
TECHNOLOGY AND INFORMATION SYSTEM

ASSIGNMENT:

ASSIGNMENT 3, MAGAZINE ON:

Application of 5G in Smart Campus, Industrial Talk 5 & 6

GROUP 6

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DUE DATE: 11/12/2021

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Application of 5G in Smart Campus

It is critical to build a new type of smart campus and information campus in the era of IR4.0, with big data, virtual reality, artificial intelligence, and other technologies that is rapidly growing nowadays. These technologies can address the inefficiency problem of our country's higher education system. In the new era, everyone should contribute to the process of college and university modernization and informatization. Therefore, we can accomplish the transfer of university education from a normal campus to an intelligent or smart campus. Some of the most important infrastructure needed to create smart campus are 5G and virtual reality.

There are many application of 5g in our life. One of them is 5G can improve virtual reality experience. 5g is vital for VR, to provide a low latency and more consistent connection. Since VR require a powerful PC to run, 5g can push the processing power, storage and power consumption to cloud. And in order to do that, 5g is important to provide a fast connectivity and handle more devices on the network. VR technology also can be used for smart campus especially for smart learning.

Virtual reality technology, or VR technology, is the combination of a range of high-tech devices that may stimulate people's senses. VR can create an immersive experience for students, teachers and lecturers. With the maturation of virtual reality technology, it is now widely utilised in education, training, construction, business, and other areas. VR technology also has a strong relation to Building Information Modeling (BIM).

Building Information Modeling, or BIM, is a technology that possesses properties such as consistency, relevance, and completeness. BIM is really important for construction and modelling 3D projects, mainly because it made the dimensions visualization so much better. BIM replaced blueprints and Computer Aided Design (CAD) because it is more efficient. BIM can help the construction of smart campus, but also is crucial for VR technology.

BIM and VR technology can be used for the development of a smart campus, while 5G will increase the efficiency of this development. BIM technology is being used for three-dimensional modelling analysis such as the virtual reality tool, while VR technology is being used for virtual presentation of architectural information models in the latter stages. Then, 5G will provide a low latency connection for online VR experience. These three factor will improve the experience in smart campus.

For example, application of virtual reality technology for fire simulation and escape since virtual reality technology is extremely customizable. The school's building can be designed using BIM technology as a virtual reality tool and Unity3D software creates the virtual campus system and interacts with scenarios. The smart campus system can simulate a fire scene more realistically thanks to the combination of BIM technology, Unity3D, and VR technology, which is conducive to increase student interest and enabling students to understand the importance of standard escape actions and knowledge of fire prevention according to fire escape drills in a relaxed environment (Wu, B. et al, 2021).

Developers utilize the system to simulate the burning flame phenomena when a fire happens in order to make the flame effect more realistic. The created flame is more realistic and bright, and the simulation effect is more authentic.

If we can combine the usage of VR technology and 5G for smart campus activities, then it is certainly sure that our experience in learning will be more immersive and fun. 5G will definitely help the progression of VR technology throughout the years and it will be no surprise if the usage of VR technology is common across all smart campus in the future.
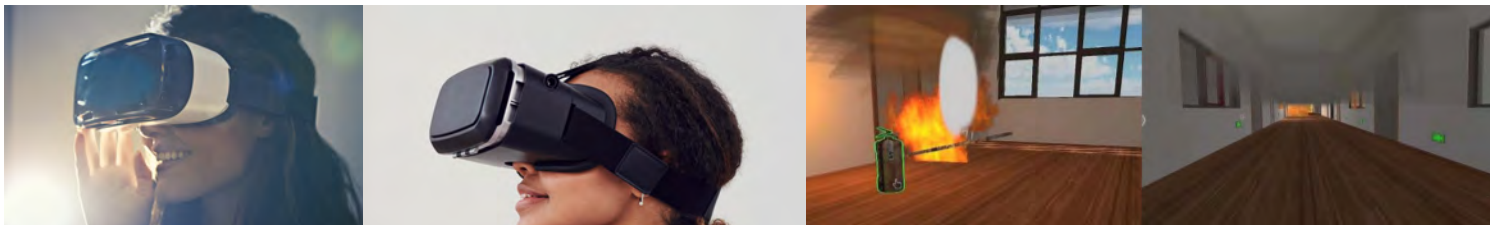
REFLECTION

From our research about 5g application in our life, we learnt that 5g can bring a lot of benefits to our life. 5g can reduce the connection latency and improve the overall experience of virtual reality (VR). Not to mention, the application of VR technology is also beneficial, especially when to create a smart campus. VR technology can be used for smart learning, such as virtual laboratory session, simulation and enhanced learning session. VR technology has a lot of potential especially for education system. Now, we are motivated to learn more about VR technology and how 5g will improve the VR experience. Maybe in the future when 5g is fully developed, we hope that VR technology will be used widely in learning process since it will improve everyone's experience with learning. Furthermore, we also learnt that 5g is more reliable than 4g. Since 5g wireless technology can deliver fast data speeds, large network capacity and improved efficiency, we should appreciate the advancement of technology and we should take advantages from this technology.

INDUSTRY TALK 5

DESCRIPTION OF THE INFRASTRUCTURE DISCUSSED

There are several infrastructure discussed in the talk, which are Wifi and Access Point, Multigigabit Technology, Unified Network Management, Internet of Things (IoT), Cloud Analytics and Smart Campus. Nowadays, the wireless paradigm shift caused an increased amount of efficiency in term of speed. Multigigabit Technology is caused by rapid increases in Wi-Fi speed. This technology drive dramatic increase in core traffic. Next, Unified Network Management which is the new approach to on-premise network management. This technology has a concept of "All in One" where one network element (network controller) control both access point and switches, rather than having two network elements.

IoT is the usage of physical objects that is connected to create a smart system. This system includes multiples technologies that connect, communicate and exchange data with other devices. After that, smart campus is something like the product of the smart city which places physical infrastructure on its own network infrastructure and create situational awareness for new services, lower costs and public safety and also using IoT to connect buildings, vehicle, people and things, but also together with the smart home which is talking about smart IoT technology at home. The combination of smart city and smart home that can attract and retain students while lowering the costs. All of the infrastructure described are vital to create a smart campus.

Smart campus is mainly divided into three main categories, which are smart living, smart learning and smart security. Looking at the smart living, we can have a smart lighting when we enter our room, our classroom, office or even the sport centre. We can also have the smart parking or smart transit in order for us to find and arrange our time to find a parking spot. The smart ID card is a must in campus nowadays due to the Covid-19 pandemic as school management may track students' movement that may take action as fast as possible if there is any emergency.

On the other hand, smart learning is one of the trends in education field which is the hybrid learning. Not only students are engaged in the campus life, but also reduces the physical contact with each other during this pandemic. When there are confirmed cases in the campus, students may have virtual labs to avoid the outbreak of the coronavirus in the campus and also undergo the quarantine. With the data collected by the campus, students can always use the data that related to their assignments and used for the assignments. In this case, projects and assignments will become more interesting and personal. Last but not least is the smart safety and security. IoT such as CCTV and VMS will do an important role for the safety in the campus. We can always refer to the CCTV to trace some incident happened such as robbery, burglary or any other cases. Other than CCTV, connected entry also playing an important role to reduce the crime rate. With the help of door access in the dormitory, the crime may not easily succeed to rob or steal as they can't even get into the dormitory. Other IoT such as motion detection and sound detection will also help in reduce students who drive speeding and management can give warning or punishment to those students.
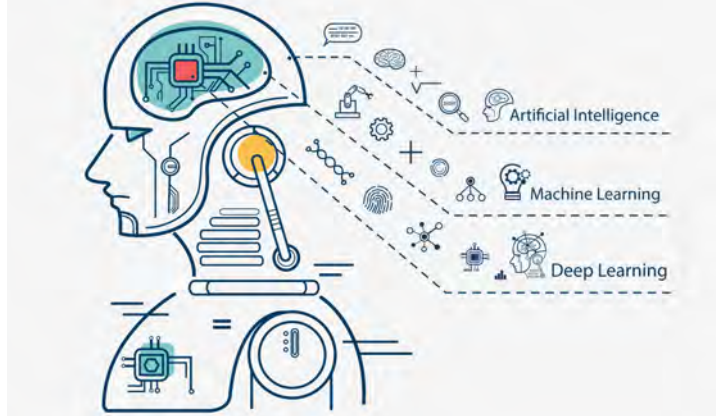
THE DEVICES USED & EXAMPLE OF DOMAIN

There are multiple Wi-Fi 6 devices in the market such as iPhone 11, iPhone 12, Playstation 5, Lenovo Yoga c940 and many more. Next, example for Multigigabit Technology is Cisco Multigigabit Technology. After that, the device used for Unified Network Management is network controller. For example, COMMSCOPE RUCKUS SmartZone. Devices used for IoT is technologies that are connected and interact with each other. For example, the usage of CCTV, smart lighting, smart ID cards, motion detection and others. Next, the example for Cloud Analytics are AWS or RUCKUS Cloud. Ruckus Cloud is a cloud computing and cloud analytics service that is provided by COMMSCOPE. Lastly will be the smart campus. Smart campus can be defined as an environment where human and technology interact with each other, to create a more exciting and immersive learning and campus experience. All of the infrastructures mentioned above can be used and applied to create a smart campus.

THE REFLECTION FROM THE TALK

From the talk, we learned that remote working is the trend of working mode nowadays and people started to look for network security because of the hackers who penetrate the network or IoT devices. We also learned that the smart campus will also be the look in the future in which students will experience smart cities and smart homes at the same time on the campus. We also noticed that implementing IoT solutions brings a lot of benefits such as reducing the cost, increasing business opportunities, enhancing customer experiences in different fields and increasing efficiency and productivity. At the same time, there will also be some challenges when deploying IoT solutions, which are connectivity, security and compatibility. On the other hand, nowadays cloud analytics is a big challenge for IT admins as it is too complex for normal humans to manage. According to the statistics given by the speaker, 42% of network professionals spend too much time on troubleshooting and 38% of the network professionals cannot proactively identify network performance issues. But in the case when IoT solutions become automated and able to self-optimizing, it will be much easier for network professionals to solve the troubleshooting or even the systems are able to troubleshoot on their own. Therefore, we are motivated in order to achieve and accomplish not only the smart campus, but also the smart city and smart home in order to bring our country to a higher platform to be more compatative with other modern countries.

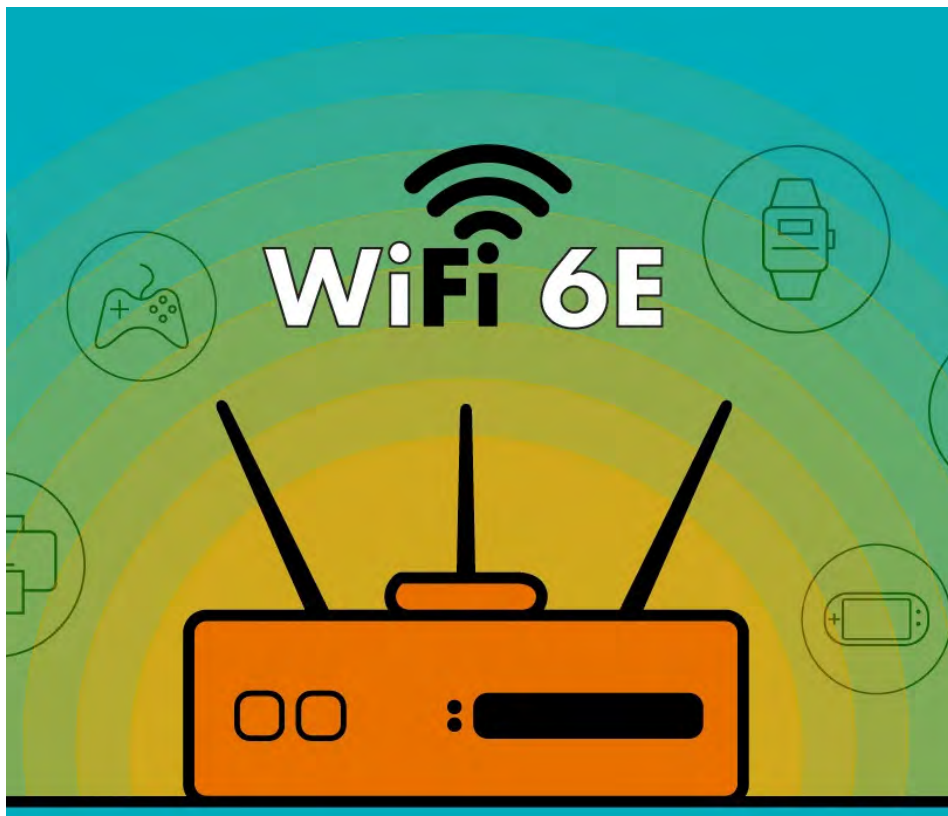# 5G, WIFI6 AND EMERGING NETWORK TECHNOLOGIES

DEVICE USED

- Virtual Reality (VR)
- Artificial Intelligence (AI)

Virtual Reality (VR) is a computer-generated environment with realistic-looking images and objects that gives the user the feeling of being completely immersed in their surroundings. High throughput for retina experience VR and low latency to avoid motion sickness are two of many reasons why VR need 5G and Wi-Fi 6.

- 5037 x 5707 resolution for retina experience per eyes
- 6 angles for full-view panoramic video mosaics
- Motion to photon delay < 20ms

Artificial intelligence (AI) is a vast branch of computer science related to the development of intelligent machines capable of doing tasks that would typically need human intelligence. Whether it's traffic data from Waze maps, sensor data from autonomous vehicles, or Netflix entertainment recommendations, artificial intelligence (AI) applications are quickly becoming a part of everyday life. Because all of these apps generate significant amounts of data that must be collected and processed in real-time, thus, 5G and Wi-Fi 6 are required.

DESCRIPTION OF INFRASTRUCTURE DISCUSSED

From the talk, we learned that the fifth generation of wireless technology systems is known as 5G. It has quicker speeds than any prior generation. For example, consumers can download movies within seconds compared to 4G. This is because of Low latency allows data streams to be sent more quickly. When compared to wifi, 5G is more flexible since it will be a platform that can link millions of devices to a single location and support a greater range of devices. From the requirements, we are able to stream 4K videos on other platforms which 4K videos are better than HD videos. The presenter also talked about the Wifi 6 standard which is the next generation of WiFi technology. Wi-fi 6, commonly referred to as "AX WiFi" or "802.11ax WiFi", is a successor to the present 802.11ac WiFi standard.

EXAMPLE

REFLECTION

AirEngine Wi-Fi 6 by Huawei is one of example of Wi-Fi 6. When compared to Wi-Fi 5, this technology can handle 4 times the bandwidth and user concurrency. Smart antenna and algorithm technologies are also included in this technology to reduce network latency. With low latency, It may reduce vertigo from VR and Augmented Reality (AR) experiences, allowing for wireless 4K High Definition (HD) conferencing and 0% packet loss during Automated Guided Vehicle (AGV) roaming.

From the talk, we learned that the fifth generation of wireless technology systems is known as 5G. It has quicker speeds than any prior generation. For example, consumers can download movies within seconds compared to 4G. This is because of Low latency allows data streams to be sent more quickly. When compared to wifi, 5G is more flexible since it will be a platform that can link millions of devices to a single location and support a greater range of devices. Also, 5G is more reliable than other current network technologies because it can be a better transmission of data in any severe situation or state. From the requirements, we are able to stream 4K videos on other platforms which 4K videos are better than HD videos. The presenter also talked about the Wifi 6 standard which is the next generation of WiFi technology. Wi-fi 6, commonly referred to as "AX WiFi" or "802.11ax WiFi", is a successor

5G is the expected replacement to 4G networks, which link the majority of today's telephones. WiFi 6 is the successor of 802.11ac as an IEEE standard for wireless local-area networks (WLANs).

to the present 802.11ac WiFi standard. Wi-Fi 6 was created in response to the increasing number of gadgets on the globe. The difference between ac for wi-fi 5 and ax for wi-fi 6 is transmission of time. Wi-Fi 6 transmission time is quicker, indicating that the pace of each spatial stream is increasing. It has the capacity to provide higher performance in terms of data carrying and can carry much more than that.

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