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TECHNOLOGY AND INFORMATION SYSTEM

GROUP ASSIGNMENT: 03- MAGAZINE ON APPLICATION OF 5G IN SMART CAMPUS & INDUSTRIAL TALKS

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Future Communication Technologies & Smart Campus

Application of 5G in Smart Campus (Temperature Measurement and Security Gate)

Smart Campus: The Journey (CommScope Malaysia)

5G, WIFI 6 and Emerging Network Technologies (HUAWEI)

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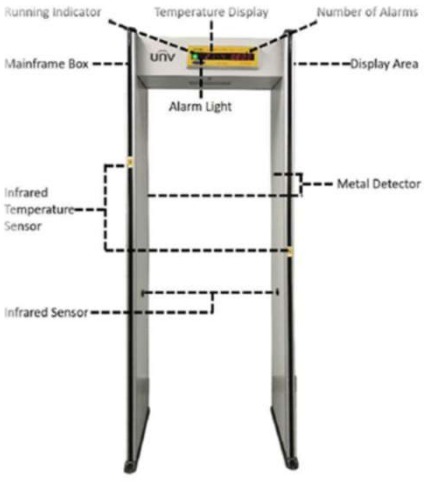
Picture 1

Picture2



Picture 3

1 Application of 5G in Smart Campus (Temperature Measurement and Security Gate)

With the gradual completion of 5G construction, 5G has been applied in more and more scenes in life. One application of 5G is Smart Campus. Maybe you are a stranger to smart campus and have no concept. Let's take a look at an ex planation of Smart Campus applications.

"In co-taught classes, multi-channel, high-definition cameras can be deployed to transmit the audio and course materials to remote classrooms many miles away simultaneously through 5G networks. However, in a classroom where AR or VR technologies are deployed, 4K videos are first recorded with high-resolution cameras, and then sent to recipients via 5G networks using special devices. The application of 5G during campus patrols help us accurately identify strangers and visitors: First, images and videos of people on campus are collected in real time with 360-degree cameras. Then, cloud-based facial recognition technology checks the faces against those stored on the authorized database."

From this explanation, we know that smart Campus, with the support of 5G technology, improves the utilization of learning resources and provides more diversified and flexible learning methods for professors and students in case of emergencies. And can maximize the security of the campus.

Today, let's focus on the application of 5G in the Smart Campus, temperature measurement and security gate. As its name suggests, it can take a student and staff's temperature as they pass, check if they are carrying dangerous goods, and use the camera to make sure there will be no strangers. Although this kind of infrared detection gate has long been used in our life, such as airport security checks, the entrance of school departments. But the existing doors are mostly connected with the local computer, compared with the local database, some of the latest cases can not be updated in time, it is likely that unknown risks can not be timely prevention.

The latest temperature measurement and security gate on campus already used 5G technology. This means that, in 5G technology, it has a database in the global scope, for example, the campus of a country in South America, temperature measuring and security gate has detected a criminal with new, never met the dangerous goods, he was marked by staff as abnormal, and with 5G of low latency and high transmission speed, security gates in Malaysia campus immediately became capable of detecting this new type of dangerous material. This is the most powerful advantage 5G brings.

Moreover, 5G has also greatly improved its temperature measurement and epidemic prevention capacity. In the past, when the temperature of a student or teacher was detected as out of bounds value, the abnormal information would be uploaded to the database, and the staff in charge would manually submit it to the local health supervision department. In this process, if any step has a problem, will lead to the spread of the epidemic on the campus with serious consequences. But with 5G, it can automatically report abnormal data to health authorities at super-fast speeds, with ultra-low latency settings. The stability and low latency of 5G makes timed uploads possible for such important matters. It not only improves security but also saves the human cost of overseeing the database, which is a significant improvement.

Picture 4

Picture 5

Picture 6

1 Application of 5G in Smart Campus (Temperature Measurement and Security Gate)

Reflection on 5G Smart Campus

In our opinion, it is a very meaningful attempt for a campus with 5G technology. Security compared with the traditional way has been greatly improved. Due to 5G having low latency, the ability to share data with databases in every country in the world as quickly as possible. So that students can be more secure when they study on campus and don't have to worry about safety issues. If in the 4G era, such long-distance transnational, large amounts of data often have extremely high latency, or even send failure.

Second, the signal of the 5G network is very stable, which is often more important than high speed for critical equipment. Assume that when detecting the suspicious person, and then security door is using 4G networks, the unstable signal causes the failure of contacting the police, this may cause a security threat to the staff, and now, under the 5G, even the very weak signals, upload and download data can also be stable, that is the most important progress, related to each one of us.

Therefore, we think 5G will bring comprehensive improvement to the construction of a smart campus, covering every aspect of everyone's school life. When 5G Smart Campus becomes widespread, it will be a very important chapter in human history.

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Picture 3: https://www.indiamart.com/proddetail/temperature-metal-measurement-security-gate-22357793397.html

Picture 4: https://www.insightsintoimpact.com/evaluative-thinking-the-heart-of-meaningful-useful-evaluation/

Picture 5: https://technews.tw/2020/09/27/5g-figure-out/

Picture 6: https://uwaterloo.ca/news/waterloo-becomes-one-canadas-first-5g-smart-campuses

Explanation of smart campus: https://carrier.huawei.com/en/success-stories/Industries-5G/Campus

2 Smart Campus: The Journey Starts Here (CommScope Malaysia)

Description of Smart Campus

A smart campus is the combination of a smart city and a smart home which is very critical to attract and reclaim the students for knowing the courses. Besides, students will get a lot of benefits which include smart living, smart learning, and smart security by having a smart campus. When we talk about smart living, we can know that the environment of smart living will contain various types of IoT devices and smart Technologies equipment such as smart ID cards, In-building LTE, Smart lighting, Smart parking or transit, Wayfinding, Personal networks as well as provide IPTV services in the hostel. Meanwhile, the smart learning environment provides the students with a flexible learning space, digital portals, virtual labs, distance learning, lecture capture, and the futuristic library. Lastly, smart security is the environment that provides smart safety and security which consists of CCTV & VMS, Connected Entry, Tracking Assets, Sound Detection, and Motion Detection.

Image 1

Description Multigigabit technology

With the Wi-Fi 6, the throughput of an AP can exceed one gigabit. A single GbE port can now restrict the performance of Wi-Fi access points, thus a desire to support connections greater than one gigabit per second between access points and switches is growing. A core switch becomes 40/100 GbE with the multigigabit infrastructure. For most applications, the connection to the switch is not the limiting factor to performance. It is more likely that a bottleneck will be caused by internet connection speed, or the response time of an application, application, user, or device. Access points must provide higher aggregate performance as Wi-Fi demand increases. Now the bottleneck between access point and switch can be up to 5Gbps throughput to have the higher performance.

Image 2

Example devices of CommScope used in Smart Campus

- CommScope Wireless Access point which is the Wi-Fi 6 that world first certified. There are many type of Access Point and all the type can support more devices that can support high density environment to have higher performance.
- Example:

1. Model of CommScope indoor access point:
   - ❖ r-series
2. Model of CommScope outdoor access point
   - ❖ t-series, p-series

Image 3

Example devices of IOT used in Smart Campus

- Lightbulb. The lightbulb can connect with the smart lighting system. For example, when walking in the room the light bulb will automatically turn on or when the surrounding has become dark the light bulb automatically turns on.
- Smart Lock. The smart lock system can auto-lock when you close the door and need the password to open the door. Smart lock also can connect with a smart alarm system to get instant phone and sound alerts when intruders try to break into your door lock.
- Vape detection. The vape detection system will be able to detect and report to the university authorities immediately if there is a student who trying to vape within the university area..

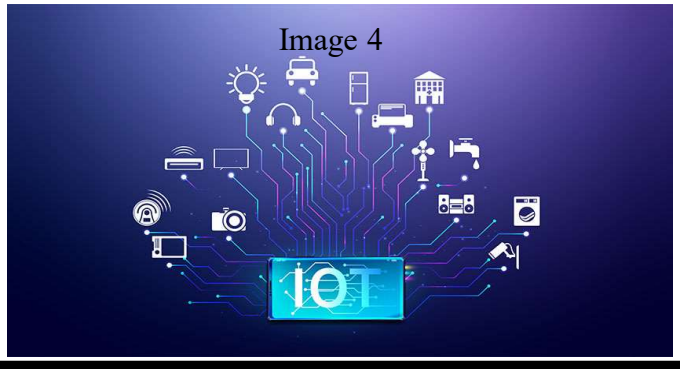

Image 4

2 Smart Campus: The Journey Starts Here (CommScope Malaysia)

Example of the domain

1. School & University

By transferring into a smart campus, the devices in school and university become more intelligent since more of the equipment changed to smart technologies. With this, more students will be attracted to learning and the environment of learning will surely be improved.

Reflection

Throughout this industrial talk, we have understood that having a smart campus will definitely bring an excellent experience to all students and lecturers. For instance, a smart ID card can allow all the staff and students on campus to purchase their food. At the same time, a smart ID card also is an identification and access medium for the staff and students in the university. Furthermore, smart learning provides flexible learning spaces and distance learning which means the teaching and learning process still can be conducted wherever the students and lecturers stay. Besides that, smart safety and security can totally ensure the safety of campus and staff efficiency. In conclusion, an undeniable smart campus will keep providing an amazing learning environment to students and lecturers in the future. Therefore, we hope the government can attempt for universities to transfer into a smart campus.

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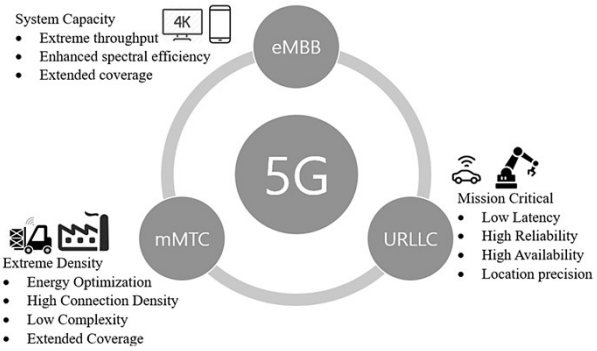

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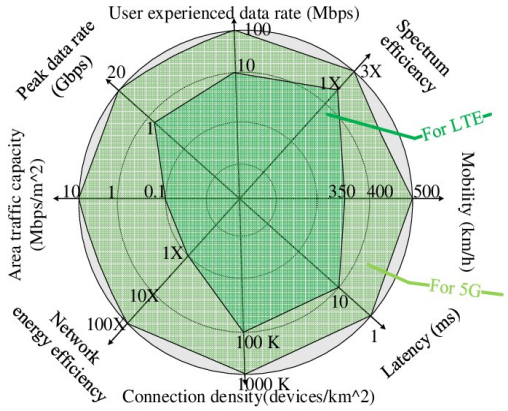


Reference: https://www.researchgate.net/figure/The-key-capabilities-of-IMT-Advanced-and-IMT-2020-as-indicators-requirements-of-4G-and5G_fig3_338737678

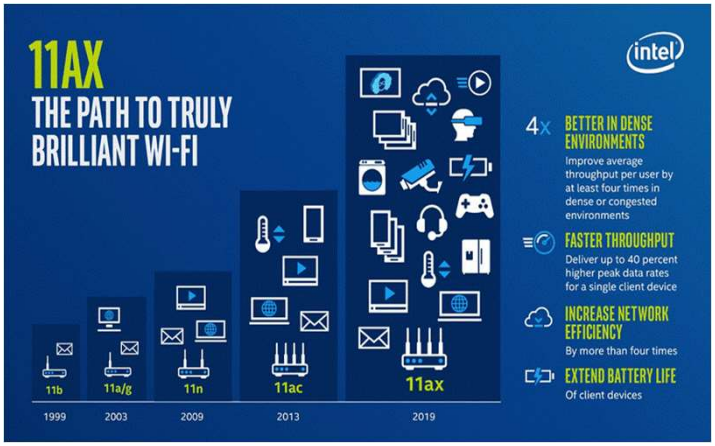
Description of WIFI 6 Infrastructure

WIFI 6 which also known as 802.11ax is the sixth generation of Wireless Fidelity which will be succeeding the current WIFI 5 (802.11ac) and WIFI 4 (802.11n). WIFI 6 was first released in the year 2019 and slowly being commercialized in the following years. WIFI 6 is significantly faster than WIFI 5 because WIFI 6 supports up to 9.6Gbps in theoretical maximum throughput due to the presence of the1024-QAM coding. Next, WIFI 6 allows the user to set up and utilize the two different radio spectrums (2.4GHz or 5GHz) according to their environment scenarios. WIFI 6 uses the OFDMA/ BSS coloring technology to allow the data packet can be transmitted simultaneously which will reduce both the delays and latency in WIFI 6 significantly. MU-MIMO feature will also allow the WIFI 6 to be capable of handling up to 4 concurrent users in order to provide a better multi-user experience. WIFI 6 is said to be used up to 30% less power as compared to previous WIFI generations. This is due to the fact that the TWT function acts as a hibernation control which only awakes the devices when data transmission is required.

3 5G, WIFI 6 and Emerging Network Technologies (HUAWEI)

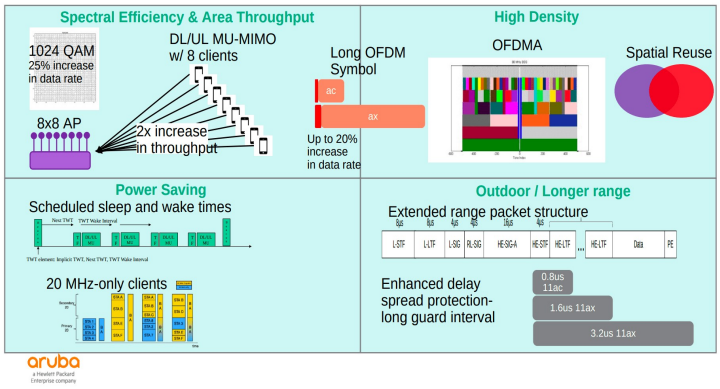
Description of 5G Infrastructure

5G (IMT-2020) is the fifth generation of wireless communication technology that will be succeeding the 4G (IMT-Advanced) & 3G (IMT-2000) networks that are commonly used nowadays. 5G can provide a greater connectivity speed which can deliver a higher download & upload speed with very low latency when compared with the previous generation of communication technology as 5G uses a higher frequency radio spectrum. Thus, this enables 5G to have the capability of transmitting huge data streams in extreme conditions when comparing previous generation such as the 3G and 4G. Additionally, 5G has a higher connection density (1 million devices/KM^2) which also allows the support of more devices within the 5G coverage.



Reference: https://www.digitaltrends.com/computing/what-is-wi-fi-6/

Categories of Enhancements



Reference: https://www.techspot.com/article/1769-wi-fi-6-explained/

3 5G, WIFI 6 and Emerging Network Technologies (HUAWEI)

Example Devices that uses 5G

1. Virtual Reality will require the high bandwidth with low latency connectivity in order to stream up to 5037*5707 resolution for retina experience per eye and avoid motion sickness.
- Example: HTC Vive/ Oculus Rift 2/ Sony PSVR/ Gear VR/ Huawei VR

2. Drone will require 5G connectivity to provide a clear live scene so the user can control and monitor the drone properly.
- Example: Delivery Drone, Personal Drone.

3. Vehicle requires 5G connectivity to collect, share the information with other vehicles on the road.
- Example: Automated Vehicle

4. Smartphone uses 5G to provide top-notch speed, ultra reliable and low latency data connectivity experience to the user.
- Example: Galaxy S21 Ultra, Redmi Note 11 Pro, iPhone 13 Pro Max, Huawei P50, Huawei Mate 40

Example Device that uses WIFI 6

WIFI 6 router requires WIFI 6 technology to provide high speed and low latency WIFI signal with higher bandwidth.
Example: Huawei AirEngine Wi-Fi 6

Smartphone utilize WIFI 6 to obtain high speed, ultra reliable and low latency WIFI connectivity experience to the user.
Example: Galaxy S21 Ultra, Redmi Note 11 Pro, iPhone 13 Pro Max, Huawei P50, Huawei Mate 40

Reference: https://www.iotforall.com/5g-vs-wifi6-iot-2019

Example of the Domain

Smart Manufacturing
- Automation of manufacturing uses 5G and WIFI 6 for the robots and IoT devices to communicate and share the information with each others more efficiently.

Smart Communications
- 5G and WIFI 6 are used to provide high speed Internet connectivity with low latency for transmitting large files, high definition video streaming, high-definition video call.

Reference: https://www.capacitymedia.com/articles/3826455/ericsson-digital-catapult-partner-on-5g-smart-manufacturing

Reflection

From the Industrial Talk, the evolution of wireless communication technologies such as 5G and WIFI 6 has greatly impacted on our lives in many aspects. These technologies will eventually improve the user's experience in the Internet world that we know today. This is because the technologies will deliver high speed connection with a very low latency and also a higher connection density (devices/ KM^2). A higher connection density broadens the availability of Internet connection to all area, especially in the area where Internet connectivity is an issue such as rural areas.

Other than that, these technologies will also enhance the existing business industries by open up more opportunities as 5G and WIFI 6 are the crucial elements to enable the transformation of business industries into Industrial Revolution 4.0. This is because business owner can utilize the 5G and WIFI 6 technologies to monitor their business performance in real-time without delays, thus they are able to analyse, forecast and predict their future opportunities more accurate and precise in order for them to expand and widen their business.