

2021年全大運創新科技應用 之賽事案例

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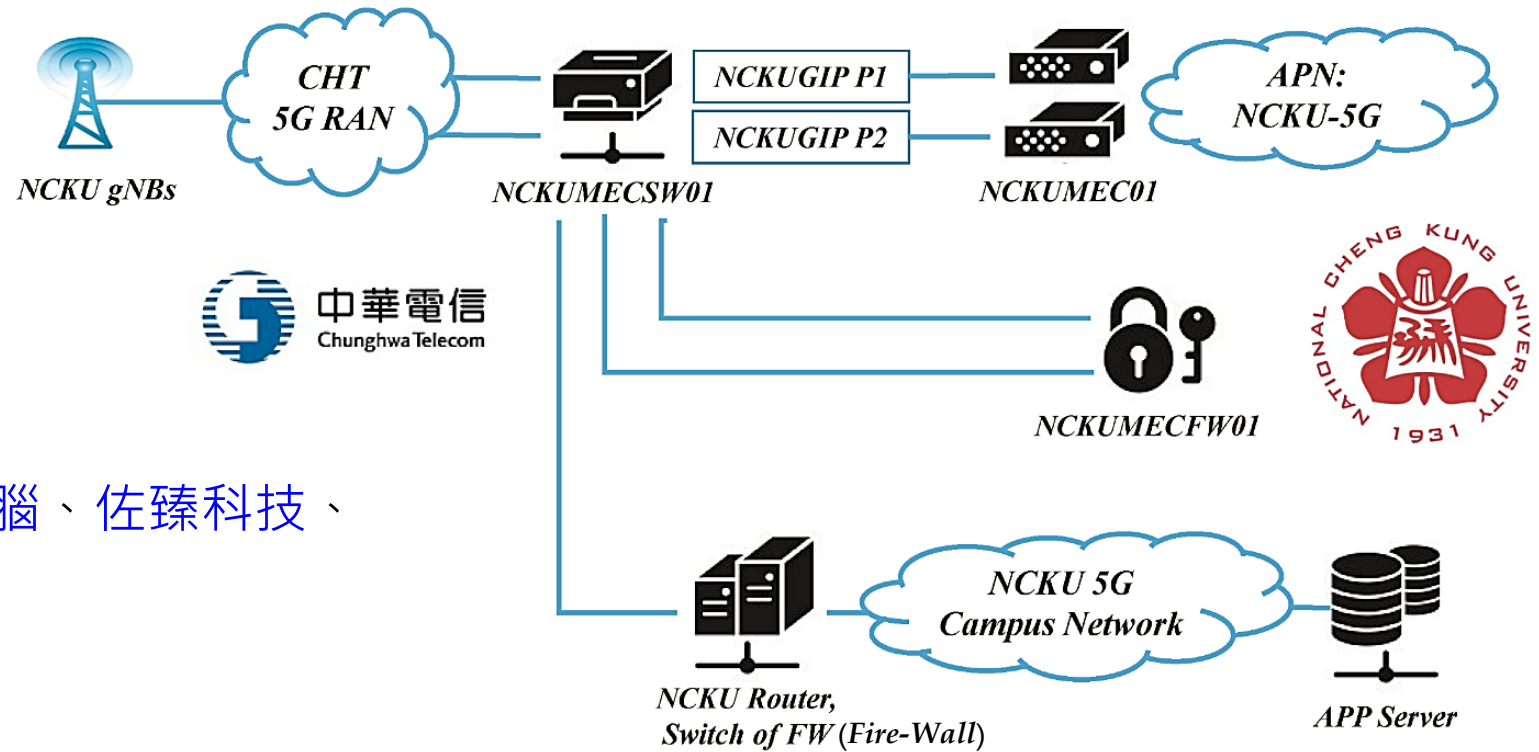
敏求智慧運算學院
Miin Wu School of Computing



ITRI
Industrial Technology
Research Institute

NCKU 5G Smart Stadium (體育館、游泳池)

- 2021年3月建置完成
- 中華電信與成大合作
- 工研院協助系統整合



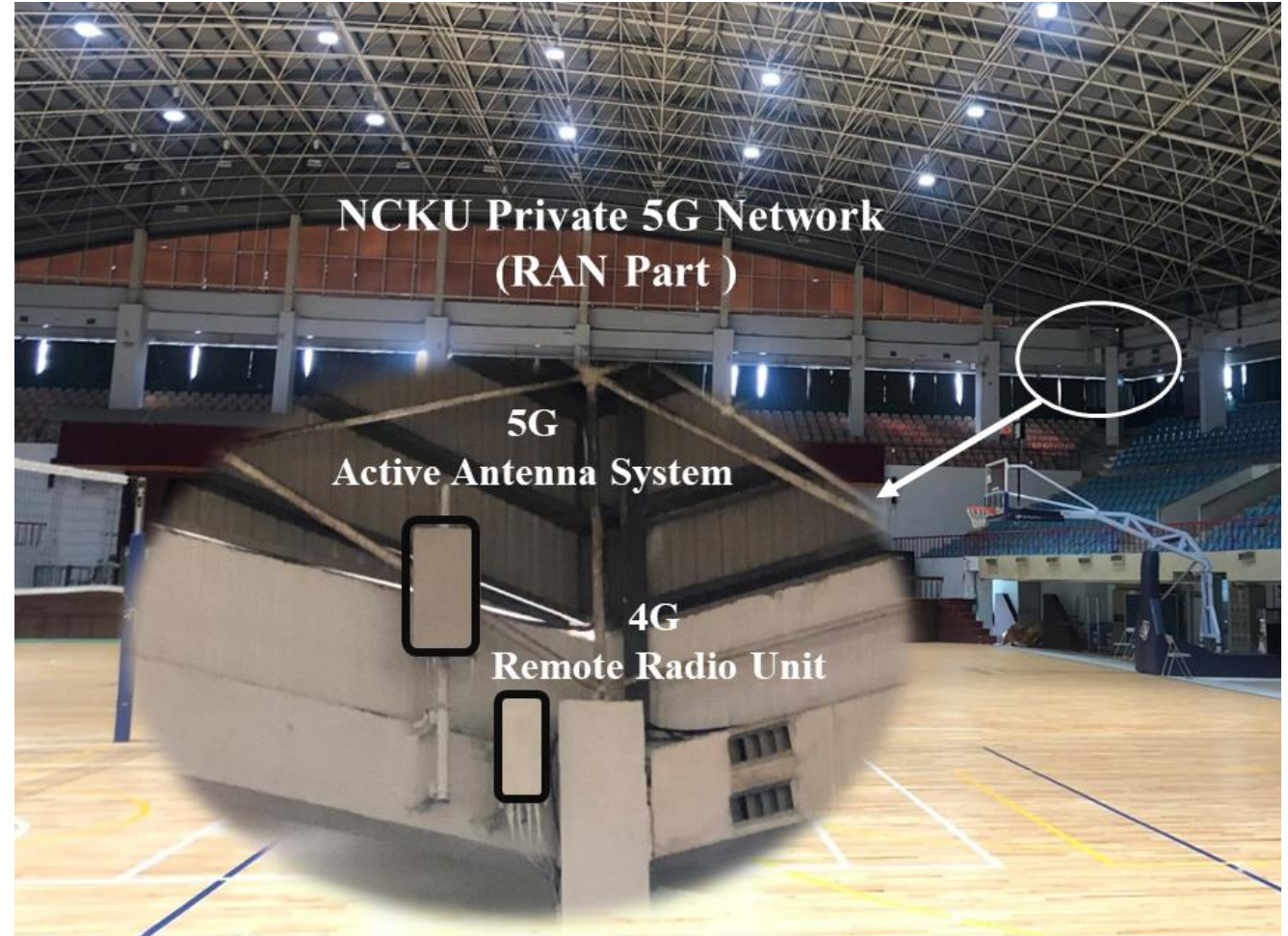
- 光陣三維、飛競鬥士、仁寶電腦、佐臻科技、中華系統整合
 - 完全台灣團隊使用台灣技術
- 高難度的系統整合(**TEBS**)
 - 5G專網
 - AI桌球落點分析及桌羽球軌跡追蹤
 - 全視野多視角高畫質的影像融合與3D隨意回放
 - 社群網路AR即時賽事直播
 - 邊緣運算即時推播
 - AI運動數據分析

- A set of *next generation NodeB (gNB)* base stations
 - Connected to the MEC servers and routers via the *CHT Radio Access Network (RAN)* and on-campus backhaul fibers

RAN of the NCKU Private 5G Network



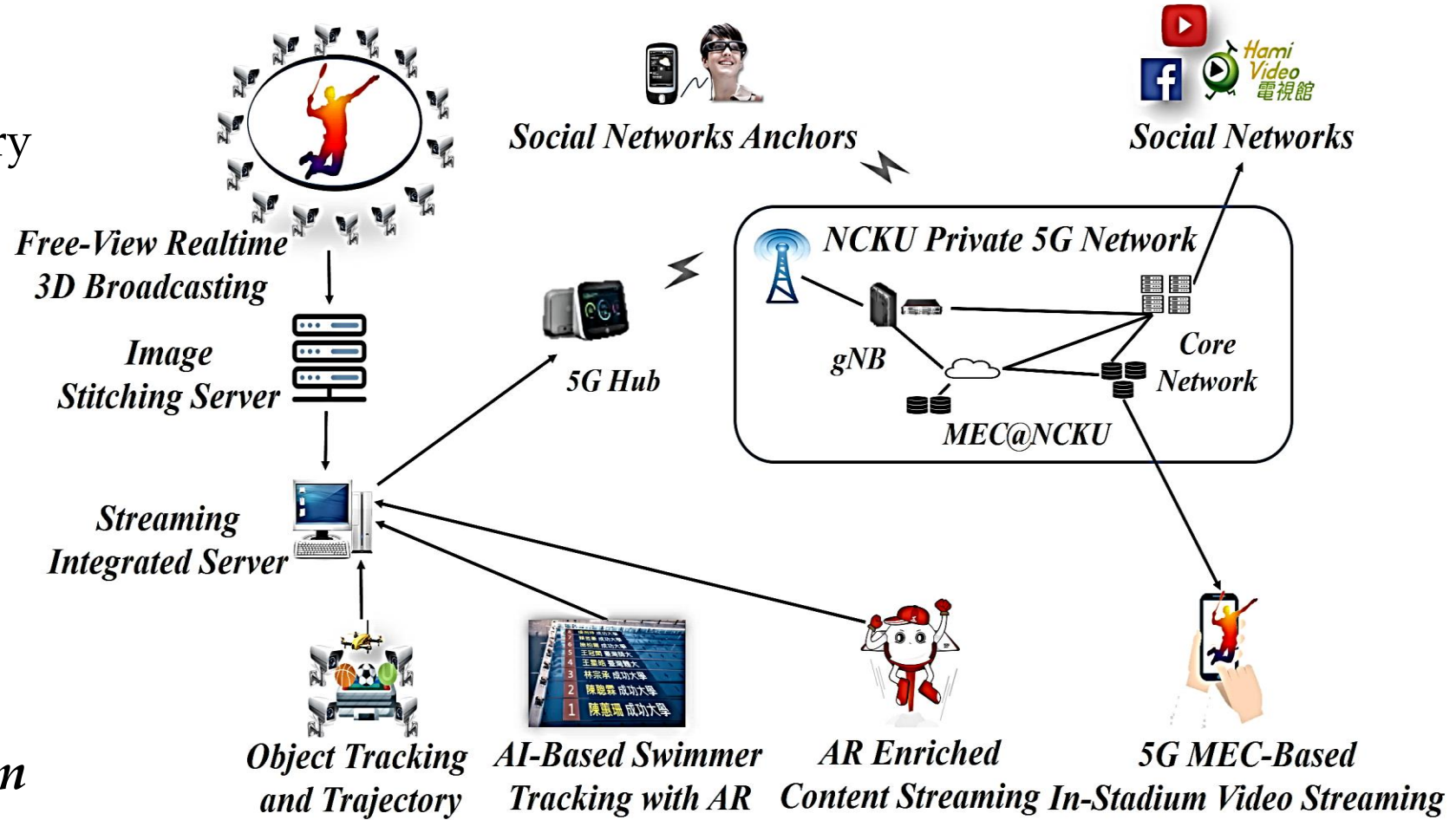
- RAN: 5G Active Antenna System & 4G Remote Radio Unit
- Compliant with the 3GPP 5G NR Release-15 Non-Stand-Alone (NSA) specifications



- Frequency: 3.5GHz (N78), 1.8GHz, 2.6GHz
- Throughput: downlink > 1.35Gbps; uplink > 153Mbps
- Latency: E2E < 30ms

Technology-Enhanced Broadcasting System (TEBS)

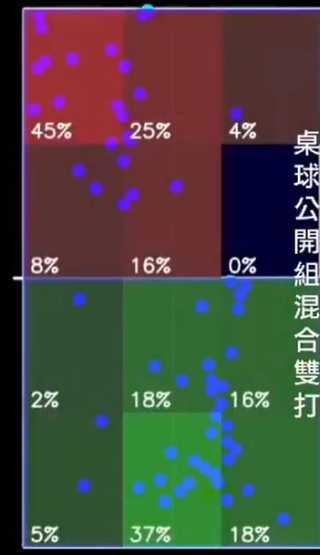
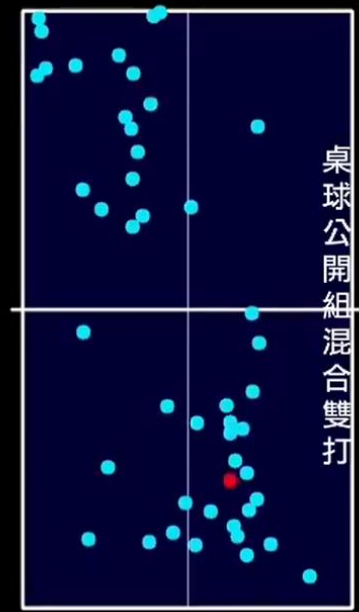
- *Object Tracking and Trajectory*
 - Table tennis ball trajectory and bounce distribution
 - Badminton shuttlecock tracking and trajectory
- *AI-Based Swimmer Tracking with AR*
- *AR Enriched Content Streaming*
- *Free-View Realtime 3D Broadcasting*
- *5G MEC-Based In-Stadium Video Streaming*



羽球技術展示舉例



Table Tennis Ball Tracking & Bounce Distribution



輔仁大學	林昀儒	2	6
	鄭怡靜		
北市大	李婉瑄	1	4
	黎昕陽		

Replay
LightMatrix

乒乓球技術展示舉例

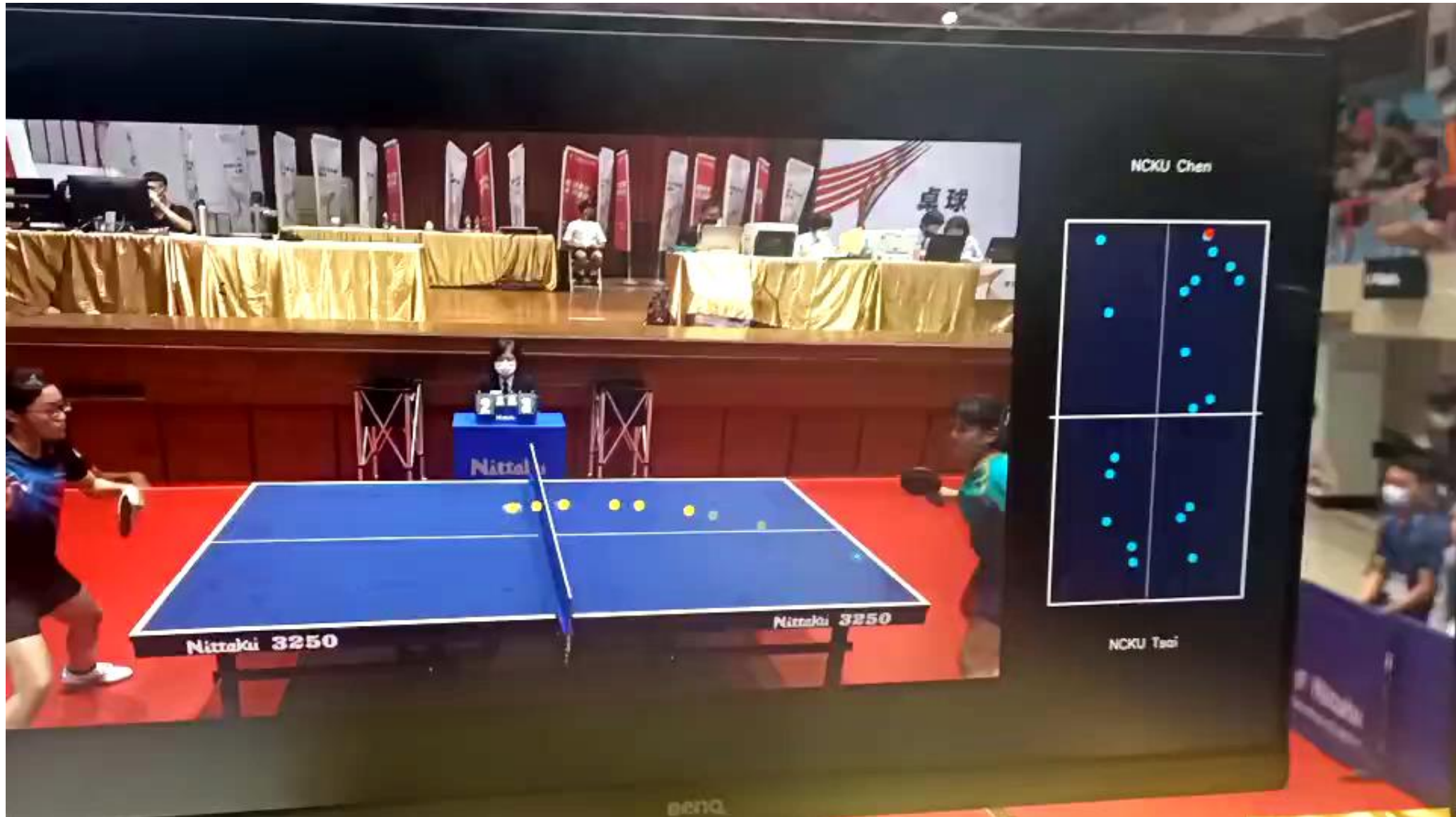
NCKU
2021

桌球公開組混合雙打

輔仁大學 林昀儒 鄭怡靜 2 0

清華大學 許柏宣 林湘庭 0 0

邊緣運算AR技術展示舉例



Multi-Swimmer Tracking for AR Generation

■ 全國紀錄 紀錄時間 03:50.66
■ 大會紀錄 紀錄時間 04:25.48
■ 女子一般 自由式接力 4*100公尺

■ 全國紀錄 紀錄時間 03:50.66
■ 大會紀錄 紀錄時間 04:25.48
■ 女子一般 自由式接力 4*100公尺

■ 全國紀錄 紀錄時間 03:50.66
■ 大會紀錄 紀錄時間 04:25.48
■ 女子一般 自由式接力 4*100公尺

4
3
2
1
3
6
8

清華大學
東華大學
陸軍官校
成功大學 04:38.82
臺灣大學 04:25.48
臺北大學 04:39.09
中央大學
輔仁大學

大會紀錄 04:25.48
全國紀錄 03:50.66

一般女生組 - 4 X 100公尺自由式接力決賽
110年全國大專院校運動會 - 游泳

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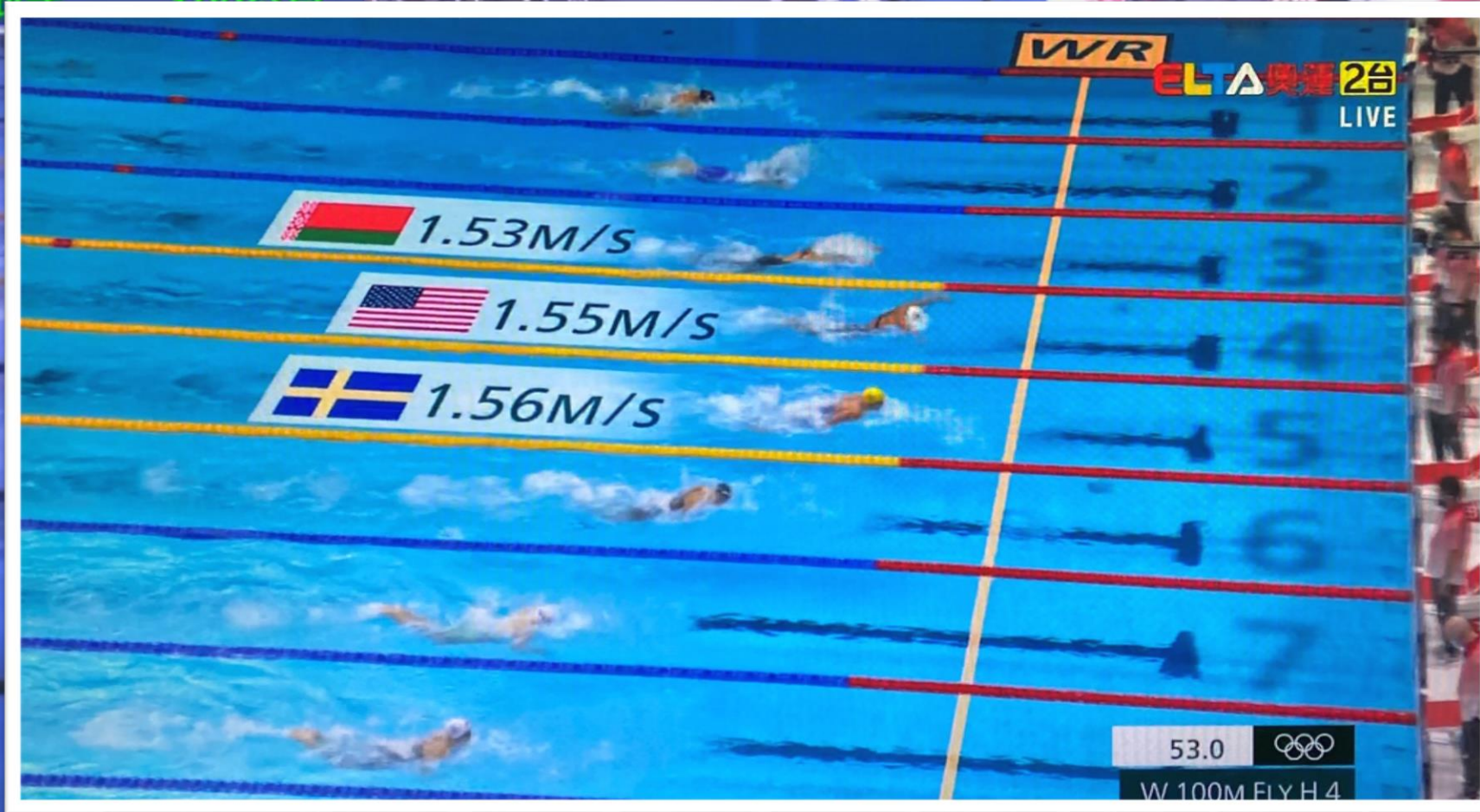
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連震杰教授

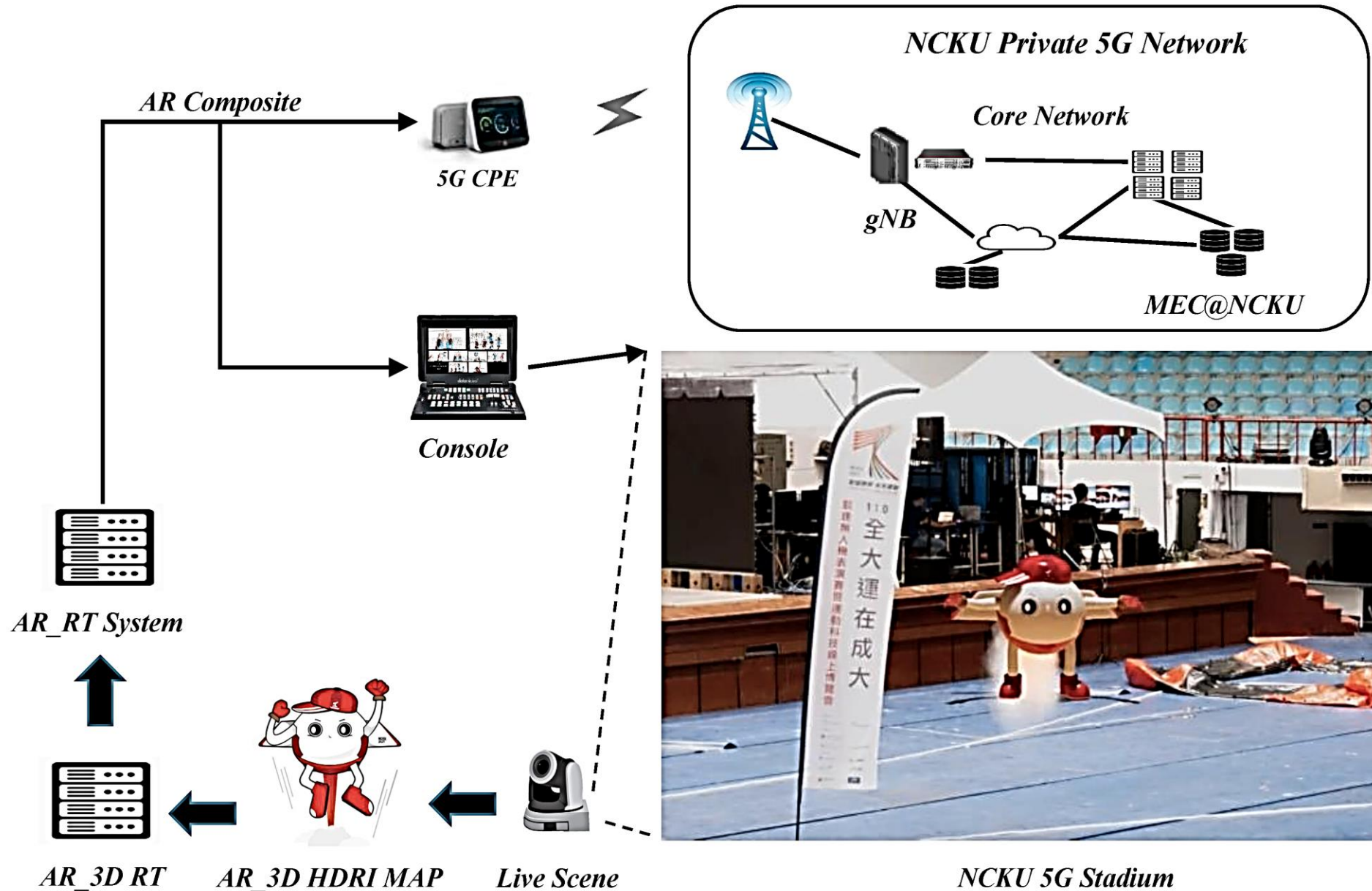
游泳技術展示舉例

■ 全國紀錄
■ 大會紀錄
男子公開

紀錄時間 00:55.11
紀錄時間 00:56.58
仰式 100公尺



AR-Enriched Content Platform in 5G Stadium



競速無人機技術展示舉例

DRONEFIGTER 2021

5G FPV Drone Racing Competition-(3 Round) Round 2
5G FPV競速積分賽 三回合制-第二回合賽

5G AR技術展示舉例



Acknowledgment

IEEE SYSTEMS JOURNAL

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Enhancing Fan Engagement in a 5G Stadium With AI-Based Technologies and Live Streaming

Cheng-Wen Wu , *Fellow, IEEE*, Ming-Der Shieh , *Member, IEEE*, Jenn-Jier James Lien, *Member, IEEE*, Jar-Ferr Yang , *Life Fellow, IEEE*, Wei-Ta Chu , *Member, IEEE*, Tsang-Hai Huang, Han-Chuan Hsieh, Hung-Ta Chiu , Kuo-Cheng Tu, Yen-Ting Chen, Shian-Yu Lin, Jia-Jun Hu, Chen-Huan Lin, and Cheng-Siang Jheng 

And: 敏求智慧運算學院、中華電信、工研院、光陣三維、飛競鬥士、仁寶電腦、佐臻科技、中華系統整合

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Abstract
We participated in Taiwan's National Intercollegiate Athletic Games (NIAG) in early May 2021, and formed a Sport Technology Team of more than 30 scholars, students, and engineers to provide novel systems and solutions that make the athletic games rich in sport technologies. Some of the features could be the first time shown to the Internet audience for large-scale athletic games. The technologies involved include table tennis ball trajectory and bounce distribution, badminton shuttlecock tracking and trajectory, augmented-reality enriched video streaming on social networks, real-time three-dimensional broadcasting with free view-angle, in-stadium video stream pushing by a private fifth-generation (5G) network with multiaccess edge computing, AI-based sport data analytics during live streaming, etc. All the technologies and applications are integrated in a novel technology-enhanced broadcasting system (TEBS) that is dedicated to sport events. This article introduces the respective technologies that we have developed, deployed, and demonstrated in the 2021 NIAG. We stress the layered architecture design and integration of the TEBS, as well as experimental results from real games in the smart stadium and swimming pool. We also discuss the technical challenges and our approaches to tackle them, as well as lessons learned.

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結語

台灣科技產業基礎

ICT

運動科技
創新系統

高粘度觀賽
體驗與互動

運動 科技

X

新創

生態正循環



粉絲經營、電子商務