# 第二章

# 技術性規格書

# 技術性規格書

1. 虛擬實驗室 V-Cave 教學設備(1.2.3.1)

請在下面打勾，逐點指出（是/否）哪些內容應符合本技術規範。
如果提供的產品與規格不同，則必須提供詳細信息。

Mandatory (M) / Desirable (D) / Optional (O)

| 項目 | 描　述 | M/D/O | 是 | 否 | 請提供詳細內容 |
|---|---|---|---|---|---|
| **虛擬實驗室 V-Cave 教學設備** | | | | | |
| 1 | **General** | | | | |
| 1.1 | An immersive cave system is expected to design for vocational training, rehabilitation (improvement) and healthy ageing (preventive) usage. The system is consisted of core CAVE enabling software, healthcare, rehabilitation & healthy ageing related simulated CAVE content library, user database, CAVE cre-ation peripherals, master CAVE engine, motion tracking sub-system, body sensory sub-system and onsite integration. All the above should work as a one whole system but cannot function separately. | M | | | |
| 1.2 | The rehabilitation and healthy ageing immersive CAVE system allows multi-user to carry out a series of training simulations in a “next to reality” environment with natural movement and actual tools. There-fore, therapists and caretakers can help subjects to achieve a better living standard and convenience in the community without logistics arrangement, embarrassment or danger in reality. | M | | | |
| 1.3 | All training data stored and personal performance dashboard available is expected. At least 100 3D training simulations covered the following area:<br>• General Nursing training<br>• Nurse Specialist Training<br>• Physical training<br>• Cognitive training<br>• Instrumental Activities of Daily Living (IADLs) Training<br>• Reality orientation<br>• Safety training<br>• Hand-eye coordination<br>• Behavioural management<br>• Emotional relaxation | M | | | |

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| | • Life & death education<br>• Values education | | | | |
| 2 | **Hardware** | | | | |
| 2.1 | LED Display | M | | | |
| 2.1.1 | 4-side CAVE environment structural dimension: approx.W4040 x L2660 x H2620mm | M | | | |
| 2.1.2 | 4-side CAVE environment visual dimension: approx. W3840 x L2560 x H2560mm | M | | | |
| 2.1.3 | P2.5 LED 3D LED panel (GOB) for 3-wall and 1-floor to form immersive VR environment | M | | | |
| 2.1.4 | 4-sided | M | | | |
| 2.1.5 | GOB protection for all LED panel plus acrylic protection for floor | M | | | |
| 2.1.6 | Resolution: 160,000 dots / sq.m. | M | | | |
| 2.1.7 | Surface mount device | M | | | |
| 2.1.8 | Dimension: 640 x 640 x 65mm per cabinet | M | | | |
| 2.1.9 | Weight: 6kg per cabinet | M | | | |
| 2.1.10 | 3D processor included | M | | | |
| 2.1.11 | Connection accessories included | M | | | |
| 2.1.12 | Lifetime: 100,000 hours to half brightness | M | | | |
| 2.1.13 | Viewing angle: 160 Horizontal, 160 Vertical | M | | | |
| 2.1.14 | Contrast Ratio: 10,000:1 / 5,000:1 (Peak/Max) | M | | | |
| 2.1.15 | Brightness: 1600 nit / 800 nit (peak/Max) | M | | | |
| 2.1.16 | 3D processors included | M | | | |
| 2.1.17 | Supporting structure included | M | | | |
| 2.1.18 | 5% spare parts of LED module to be included | M | | | |
| 2.2 | CAVE Master Engine | M | | | |
| 2.2.1 | CPU: Intel Core i9 or higher | M | | | |
| 2.2.2 | RAM: 64GB or higher | M | | | |
| 2.2.3 | Storage: 2 TB SATA SSD or above | M | | | |
| 2.2.4 | Graphics card: GeForce 5080 or above | M | | | |
| 2.2.5 | Audio output for Immersive CAVE | M | | | |
| 2.2.6 | Microsoft Window 11 Professional license | M | | | |
| 2.2.7 | Immersive CAVE enabler (Cave software) should be embodied in master server engine, so that it can support all software functionality | M | | | |
| 2.2.8 | All-in-one server console with touch monitor, controlling accessories, mouse and keyboard included | M | | | |

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| 2.2.9 | Qty: 1-set | M | | | |
| 2.3 | Optical Tracking System | M | | | |
| 2.3.1 | An infrared optical tacking system should be integrated into the immersive CAVE enabler to perform perspective and motion tracking function. | M | | | |
| 2.3.2 | The integrated optical tracking system should allow multiple users in tracking area without intervene. | M | | | |
| 2.3.3 | Identification and tracking of unlimited targets / tools are supported, so motion / gesture capture / markless tracking is not an option. The system mainly receive command by the motion tracking system, keyboard nor additional touch device is not necessary. | M | | | |
| 2.3.4 | Optical tracking camera:<br>• Resolution: 1280 × 1024<br>• Frame Rate: 240 Hz<br>• Field of view (FOV) (H x V) 82° x 70°<br>• Latency: 4.2 ms<br>• 3D Accuracy: +/- 0.30 mm<br>• Passive Markers: 9 m (30')<br>• Active Markers: 15 m (50')<br>• Default Speed: 0.25 ms<br>• Minimum Speed: 0.01 ms<br>• Maximum Speed: 3.9 ms at 240 fps<br>• Image Processing Types: Object, Segment, Raw Grayscale, MJPEG Grayscale<br>• LED Ring: 10 LEDs Ultra High Power 850 nm infrared<br>• Lens & Filter: Adjustable focus 850 nm band-pass filter<br>• Built-in image processor included<br>• Compatible software driver included<br>• Quantity: 6-camera | M | | | |
| 2.3.5 | Tracker:<br>• 1 x wireless wand retroreflective tracker affixed to controller<br>• 1 x wireless head retroreflective tracker affixed to 3D stereo glasses<br>• Integration and calibration with CAVE server engine | M | | | |

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| 2.3.6 | Wireless navigation controller:<br>• 1 x wireless input controller<br>• X and Y axis for position<br>• One hand controlling device<br>• 2.4Ghz ISM band frequency hopping<br>• 9 programmable buttons with self-definition function | M | | | |
| 2.4 | 3D Stereo Glasses | M | | | |
| 2.4.1 | Weight: up to 40g | M | | | |
| 2.4.2 | Battery (Rechargeable): 30 hours continuous operation after fully charged (auto-off) | M | | | |
| 2.4.3 | Wireless: RF | M | | | |
| 2.4.4 | Compatible with 3D visual equipment below | M | | | |
| 2.4.5 | 25-unit included | M | | | |
| 3 | **Software** | | | | |
| 3.1 | LED System (CAVE Enabler Programme License | M | | | |
| 3.1.1 | Allow multi-user to enter and immerse in same scene to share CAVE experience without intervene | M | | | |
| 3.1.2 | Free of Head Mounted Device (HMD) so that all users can maintain eye contact | M | | | |
| 3.1.3 | 1:1 scale simulated environment to create sense of reality in virtual world | M | | | |
| 3.1.4 | Freely walk through or travel around in VR within motion tracking area | M | | | |
| 3.1.5 | Calculation and processing of all 3D data generated from optical tracking system and output stable signal of 60Hz and 120Hz to 1-6 sides of 3D real-time rendered immersive CAVE environment without noticeable delay | M | | | |
| 3.1.6 | Perspective and motion tracking in up to 6-side blended multi-user environment | M | | | |
| 3.1.7 | Unlimited physical objects tracking | M | | | |
| 3.1.8 | Simulated 2D or frame sequential 3D modes, one-button switch available during content display | M | | | |
| 3.1.9 | Support 360, VR navigation and interactive, MR interactive applications | M | | | |
| 3.1.10 | Support user’s unlimited import of 360, VR environment and 3D objects | M | | | |
| 3.1.11 | 3D display method: frame sequential | M | | | |

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| 3.1.12 | 360 and 3D simulated content thru CAVE enabler is responsive to system dimension and hardware equipment without distortion | M | | | |
| 3.1.13 | Lightweight, wireless, rechargeable stereo 3D glasses for all users in 3D mode; glasses free when 2D mode is on | M | | | |
| 3.1.14 | Support shutter 3D stereo glasses at 60Hz and 120Hz | M | | | |
| 3.1.15 | Without third party software processing for import of 3D simulated application | M | | | |
| 3.1.16 | Compatible file or data formats including but not limited to PTS, E57, OBJ, FBX, 3DsMax, Unity, Revit, Rhino, Zbrush, Sketch-up, AVI, MP4, PNG, JPG | M | | | |
| 3.1.17 | YouTube player available for saving and replay of online real-time 360 resource | M | | | |
| 3.1.18 | PPT player available for saving and replay of PPT in 360 format | M | | | |
| 3.1.19 | Support 360, VR navigation and interactive, MR interactive applications | M | | | |
| 3.1.20 | Support user’s unlimited import of 360, VR environment and 3D objects | M | | | |
| 3.1.21 | Support real-time drawing, marking, measuring in 3D immersive CAVE environment | M | | | |
| 3.1.22 | Support different gestures to move, rotate, enlarge, flip, select objects | M | | | |
| 3.1.23 | Support drawing and writing functions | M | | | |
| 3.1.24 | Allow additional info, picture, 3D model pop-up in 3D immersive CAVE environment | M | | | |
| 3.1.25 | Support QR code login to identify users and training tools | M | | | |
| 3.1.26 | Database system available for administrator / therapist / trainer to monitor users’ performance | M | | | |
| 3.1.27 | Personal performance dashboard available for review training progress | M | | | |
| 3.1.28 | Compatible with haptic feedback technology | M | | | |
| 3.1.29 | Embodied with existing rehabilitation related content library | M | | | |
| 3.1.30 | Permanent license of CAVE enabler (LED system) included | M | | | |
| 3.2 | LED System cave software user interface | M | | | |
| 3.2.1 | On-off: one-button system on and off | M | | | |
| 3.2.2 | 2D/3D button: switching of 2D / 3D frame sequential display with one button on handheld control and control panel | M | | | |

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| 3.2.3 | Language selection: switching of EN/TC/SC with one button on handheld control and control panel | M | | | |
| 3.2.4 | 3D adjustment, 3D formats selection, motion tracking selection buttons, software version display and update alert, 3D format file and 360 Video import short cut key available | M | | | |
| 3.2.5 | Responsive display available | M | | | |
| 3.3 | User database | | | | |
| 3.3.1 | Personal database backend and UI available to record users' performance and progress | M | | | |
| 3.3.2 | Compatible with LED System cave software and content library trainings | M | | | |
| 3.3.3 | Personal login: support QR code button free login to identify users and training tools | M | | | |
| 3.3.4 | Max. 4 users login and 4 corresponding trackers in the same game | M | | | |
| 3.3.5 | Admin login to create, update and review users' record | M | | | |
| 3.3.6 | Admin is allow to set disclosure level | M | | | |
| 3.3.7 | Separate dashboard for each group, user and game | M | | | |
| 3.3.8 | Dashboard information: access time, duration, training selection, each training duration, results, trends with data visualisation | M | | | |
| 3.3.9 | Allow to import unlimited user profile by MS excel and manual input | M | | | |
| 3.3.10 | Unlimited real-time cloud storage | M | | | |
| 3.3.11 | The CAVE enabler (LED System cave software) should perform a sustainable nature of easy CAVE creation: | M | | | |
| 3.3.12 | Allow unlimited import of 360 panoramic video, 3D content, 3D model, Virtual Reality and Mixed Reality programmes interaction and visualisation | M | | | |
| 3.3.13 | Both professional and layman end-user can create and control CAVE content production in long run | M | | | |
| 3.3.14 | For professional user, they should be able to import professional models without manual touch-up. End users can create and import content on their own with professional software (e.g., engineering, architecture, survey, multimedia or so forth) or tools (e.g., 3D laser scanner) that are commonly found in professional industries | M | | | |

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| 3.3.15 | For layman user, the CAVE enabler should be compatible with plug-in CAVE creation tools so that non-professional users can create interactive 360 VR and interactive 3D simulation by drag-n-drop without coding. 3D visualiser or Unity programmer are not a must in CAVE content creation | M | | | |
| 3.4 | 3D Simulated Content Library | M | | | |
| 3.4.1 | At least 100 content to be provided, new content will be added to the pool from time to time | M | | | |
| 3.4.2 | All content should be 3D simulated and interactive | M | | | |
| 3.4.3 | The 3D simulated CAVE content should be responsive to Immersive environment and dimension | M | | | |
| 3.4.4 | The 3D simulated CAVE content should respond to the above infrared optical motion tracking system | M | | | |
| 3.4.5 | All content should be nursing / rehabilitation / education related, including but not limited to the followings | M | | | |
| 3.4.6 | a. General Nursing training, such as:<br>• wound dressing<br>• patient ward operation<br>• scenario management in patient ward etc.<br>b. Nurse Specialist Training, such as:<br>• manipulation of laparoscopy<br>• skin Preparation and draping<br>• management of patient in difficult Airway<br>• the above specialty trainings should be endorsed by medical training institutions<br>c. Physical training<br>d. Cognitive training<br>e. Instrumental Activities of Daily Living (IADLs) Training<br>f. Reality orientation<br>g. Safety training<br>h. Hand-eye coordination<br>i. Behavioural management<br>j. Emotional relaxation<br>k. Life & death education<br>l. Values education | M | | | |
| 3.4.7 | Content update available within warranty period | M | | | |

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| 3.4.8 | The 3D simulated models should be based on Chinese community based scene | M | | | |
| 3.4.9 | All 3D simulated content should be 3D model based (10 million to 20 million polygon) and with at least 5 layers | M | | | |
| 3.4.10 | Level selection is available in all 3D simulated content in order to suit different users' abilities and needs | M | | | |
| 3.4.11 | Permanent license | M | | | |
| 3.4.12 | Vendor must demonstrate extensive experience in healthcare industry and established solid relationship with reputable hospitals, healthcare and medical training institutions. Endorsement of the above organisation is preferred | M | | | |
| 4 | Service | | | | |
| 4.1 | Installation | M | | | |
| 4.1.1 | Installation, setup and connection of all new and existing hardware | M | | | |
| 4.1.2 | Configuration and calibration of all connected systems included | M | | | |
| 4.1.3 | Preparation of documentation and manuals for operation and trainings | M | | | |
| 4.1.4 | User Acceptance Test shall be taken place after installation immediately | M | | | |
| 4.1.5 | Independent switches for the system included | M | | | |
| 4.1.6 | Conduit work from MCB to switches included | M | | | |
| 4.1.7 | Connection to the system | M | | | |
| 4.1.8 | 32amp 3-phase MCB included | M | | | |
| 4.2 | Training | M | | | |
| 4.2.1 | Onsite Training after installation | M | | | |
| 4.2.2 | User Menu | M | | | |
| 4.3 | Warranty | M | | | |
| 4.3.1 | At least 1-year warranty included | M | | | |
| 4.3.2 | Unlimited offsite support via WhatsApp, email and telecom | M | | | |
| 4.3.3 | Distance diagnose and trouble shoot available | M | | | |
| 4.3.4 | Max. 4 times of onsite support annually | M | | | |
| 4.3.5 | Maintenance and repairing of all deliverables with all parts (incl. LED module), labour and logistics included | M | | | |
| 4.3.6 | Consumable parts are excluded | M | | | |
| 4.3.7 | Response within 2-hour on business day upon service calls received | M | | | |

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|---|---|---|---|---|---|
| 4.3.8 | Onsite technical support and repairing within 5-working day upon request (excl. consumable parts) | M | | | |
| 4.3.9 | Programme version and the training software update upon availability | M | | | |