NACOTS

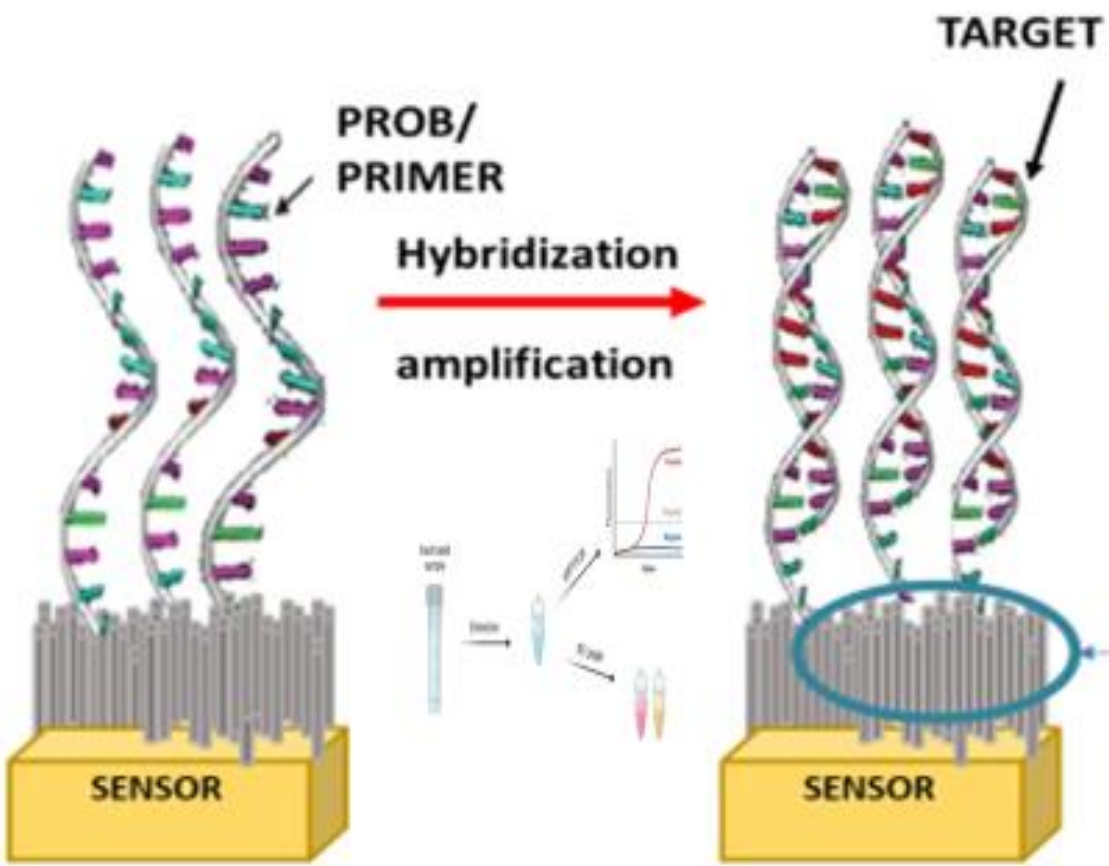
Nanosystem for COVID19 DNA/Antibodies on the Spot Test (NACOTS)

- DNA Detection Device
- DNA Marker Reagent
- Portable
- Compact
- IoT-Based Software
- Clinically proven to detect Covid-19 DNA

NACOTS Team

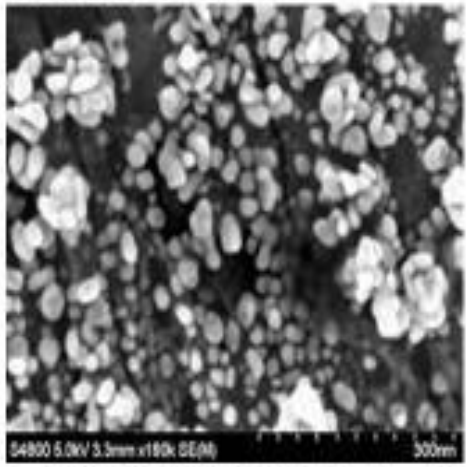
- NACOTS team members:
  1. Assoc Prof Dr Zainiharyati Mohd Zain (UiTM): Project Leader MOSTI grant
  2. **Prof. Ts. Dr. Teddy Surya Gunawan** (IIUM)
  3. Prof. Anis Nurashikin Nordin (IIUM)
  4. Assoc. Prof. Dr. Rosminazuin Ab Rahim (IIUM)
  5. Assoc Prof Dr Lim Ying Chin (UiTM)
  6. Assoc Prof Dr Yusairie Mohd (UiTM)
  7. Dr Mohd Shihabuddin Ahmad Noorden (UiTM)
  8. Dr. Rozainanee Mohd Zain (IMR)
  9. Dr. Mohd Fairulnizal Mohd Noh (IMR)
  10. Muhammad Afiq Abdul Ghani (IIUM)
  11. Muhammad Khairul Faisal Muhammad Atan (IIUM)
  12. Faisal Ahmed Assaig (IIUM)
  13. Munirah Zulhairee (UiTM)
  14. Adibah Che Mohamad Nor (UiTM)
  15. Nur Asyiqin Azman (UiTM)
- Research collaboration between UiTM, IIUM, and IMR.

SENSOR DNA



Peranti

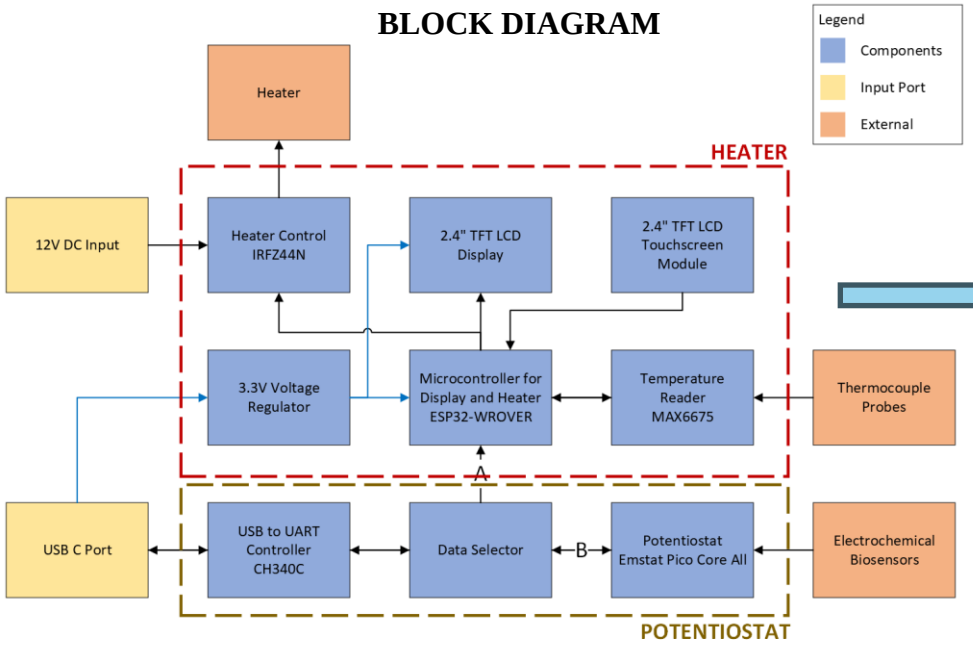
Bahan Nano



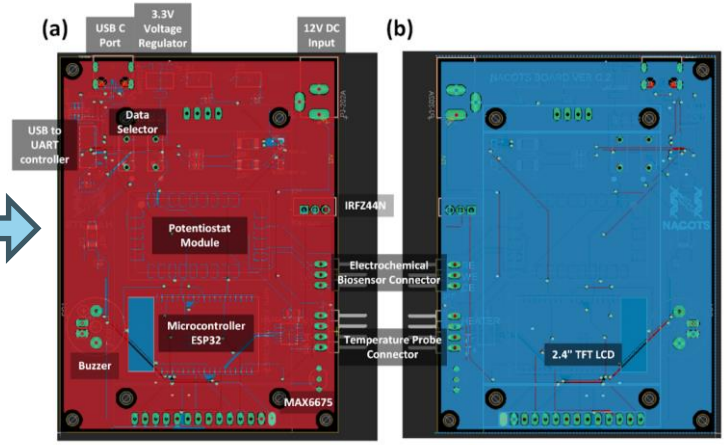
Patent (PI2023002953)
: A Detection and Method For Detecting SARS-CoV-2

Patent (PI2023000465): Method Preparing A Double Coated Screen Printed Electrode and The Use Thereof

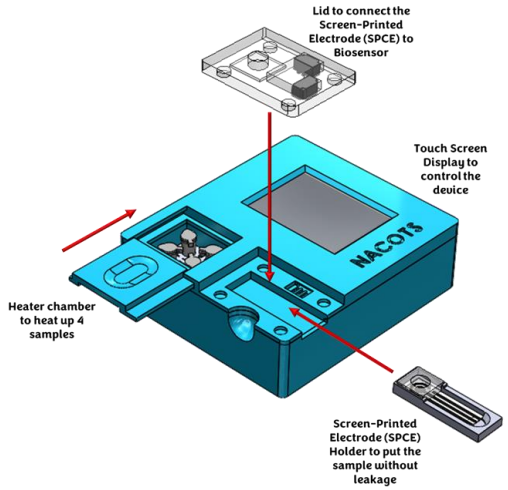
BLOCK DIAGRAM

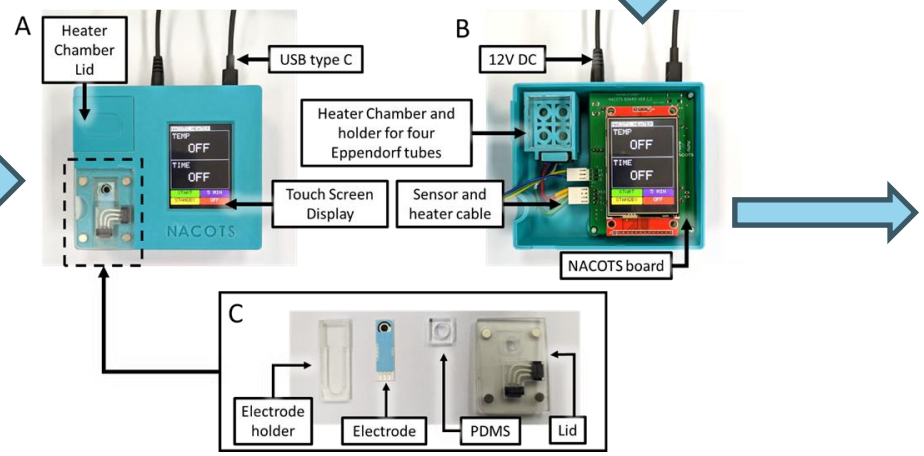


PRINTED CIRCUIT BOARD DESIGN FOR NACOTS



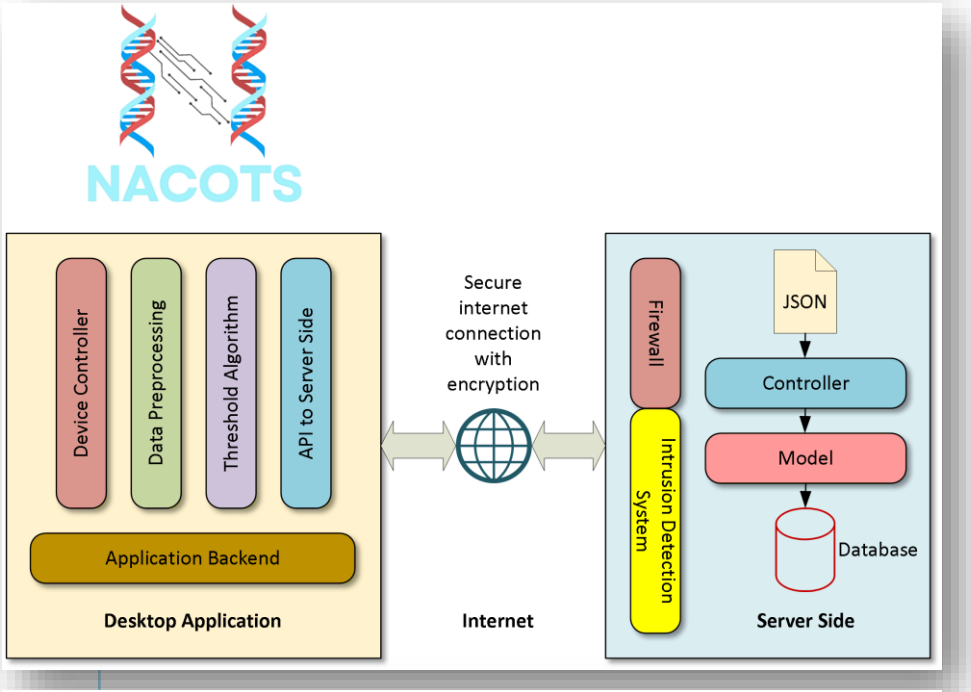
NACOTS SOFTWARE DESIGN AND DESKTOP APPLICATION DEVELOPMENT

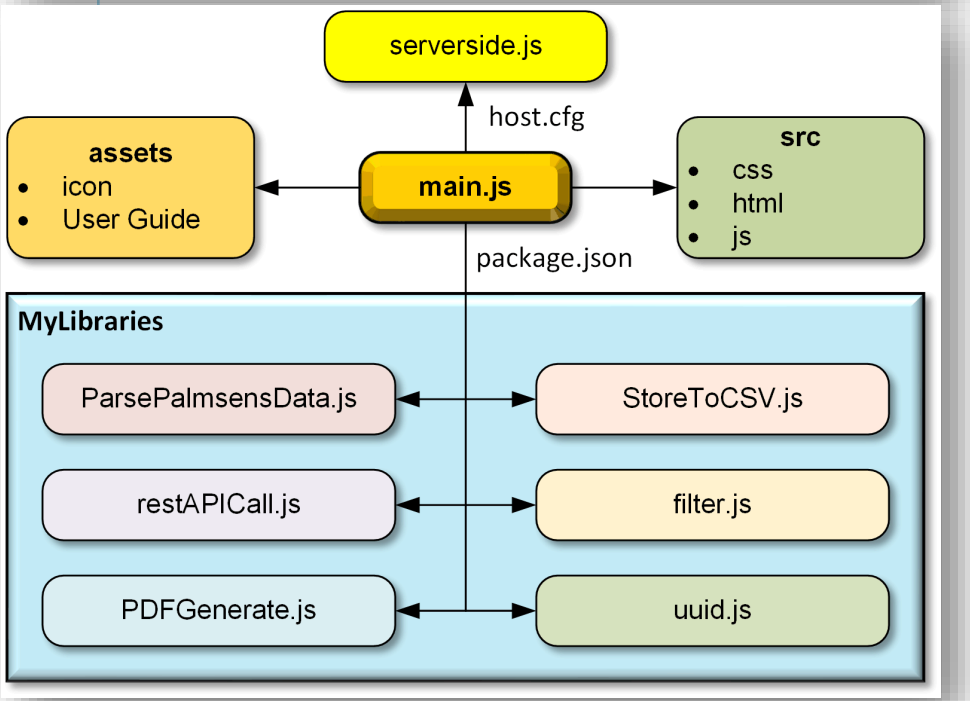


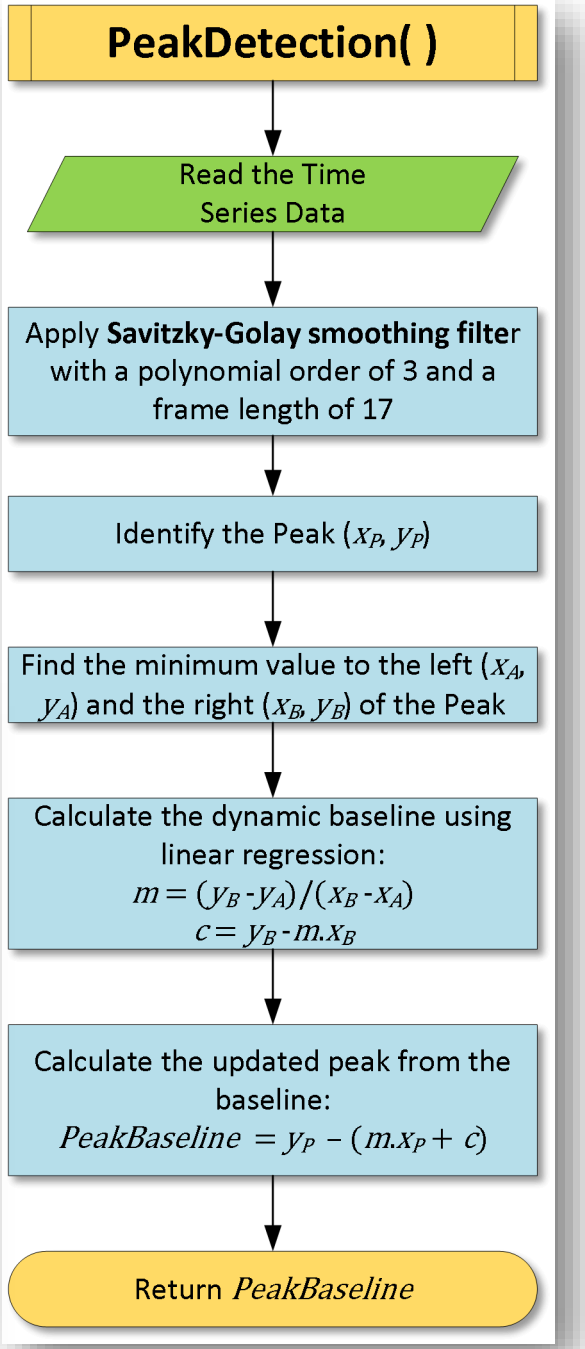


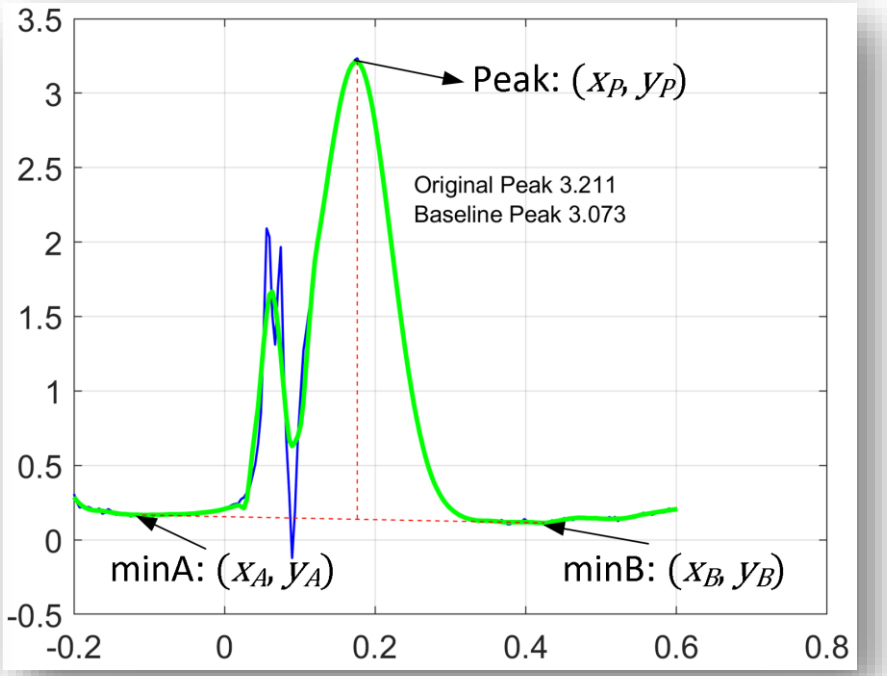
CASING AND HEATING CHAMBER DESIGN

OVERALL EXPLODED VIEW OF NACOTS DEVICE





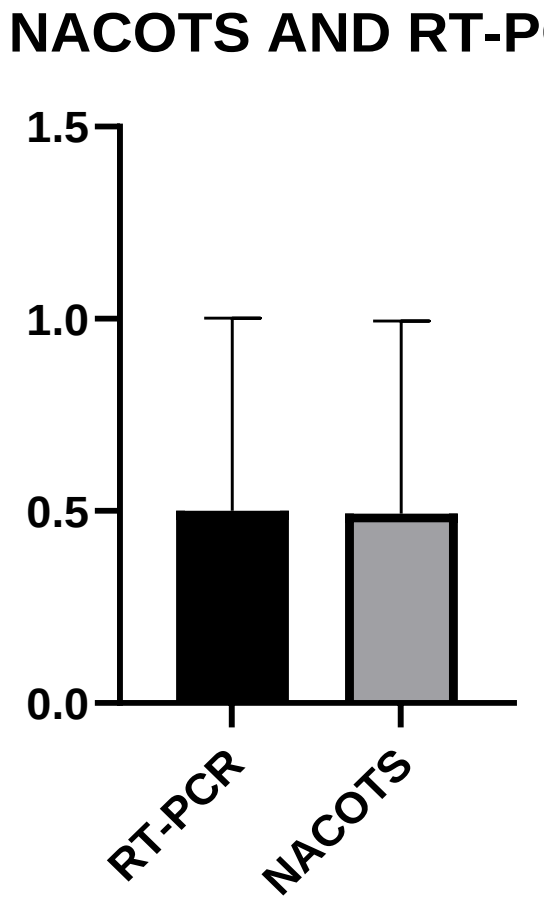




Covid 19 Sample Classification

$s = savitzkyGolay(current)$
$P = p(s)$
$range_A, range_B = findRange(P)$
$A = \min(range_A)$
$B = \min(range_B)$
$line_{base} = findBaseLine(A, B, voltage)$
$Peak_{measured} = distance(line_{base}, P)$
$\Delta = Peak_{blank} - Peak_{measured}$
If Δ *Threshold*
    Covid 19 sample is positive
else
    Covid 19 sample is negative
endif

Significance Difference between RT-PCR and NACOTS (N=148)



Unpaired t-test	
p-value	0.9078
Significant different (p < 0.05)?	Not Significant

The p-value between NACOTS and real time RT-PCR is p=0.9078 (p>0.05). There is no significant difference between gold standard, real time RT-PCR and novel COVID-19 assay, NACOTS at 95% confidence interval.

We validated our work with the MoH SOP. The ethics approval was granted by UiTM Research Ethics Committee (REC) with a referral number REC/03/2022 (PG/MR/51) on August 2022 and Medical Research Ethics Committee (MREC), MOH with a referral number NMRR ID-22-006675-CFP; Protocol ID: 14022022 on March 2022.

Publication

- Journal publications:
  - Azman, N.A., Mohd, Y., Zain, Z.M., Y.C., Lim (2023). Modification of screen-printed carbon electrode with nanoporous gold by electrodeposition and dealloying of gold-copper alloy. International Journal of Nanoelectronics and Materials.
  - Nor, A. C. M., Zain, Z. M., & Noorden, M. S. A. (2023). Application and Modification of RT-LAMP for Rapid Detection of SARS-CoV-2 Viral Genome. Malaysian Journal of Medicine and Health Sciences, 19(2), 286-292.
  - Abdul Ghani, M. A., Nordin, A. N., Zulhairee, M., Che Mohamad Nor, A., Shihabuddin Ahmad Noorden, M., Muhamad Atan, M. K. F., ... & Mohd Zain, Z. (2022). Portable electrochemical biosensors based on microcontrollers for detection of viruses: a review. Biosensors, 12(8), 666.
  - Assaig, F. A., Gunawan, T. S., Nordin, A. N., Rahim, R. A., Zain, Z. M., Zain, R. M., & Arifin, F. (2023). Development and Evaluation of a High-Performance Electrochemical Potentiostat-Based Desktop Application for Rapid SARS-CoV-2 Testing. Indonesian Journal of Electrical Engineering and Informatics (IJEEI), 11(2).
- Conference publications:
  - Atan, M. K. F. M., Rahim, R. A., Nordin, A. N., Gunawan, T. S., & Zain, Z. M. (2022, September). Investigation of Fluid Flow System Performance for Biosensor Application. In 2022 IEEE 8th International Conference on Smart Instrumentation, Measurement and Applications (ICSIMA) (pp. 159-162). IEEE.
  - Ghani, M. A. A., Nordin, A. N., Rahim, R. A., Gunawan, T. S., & Zain, Z. M. (2022, September). Evaluation of Portable Potentiostats for Electrochemical Measurements: Voltammetry and Impedance Spectroscopy. In 2022 IEEE 8th International Conference on Smart Instrumentation, Measurement and Applications (ICSIMA) (pp. 132-137). IEEE.
  - Jafar, N. F., Mohd, Y., Chin, L. Y., Noorden, M. S. A., Noh, M. F. M., Zain, R. M., & Zain, Z. M. (2023, May). Global research trends on COVID-19 biosensor using scopus database. In AIP Conference Proceedings (Vol. 2720, No. 1). AIP Publishing.

Intellectual Property

- Patent submissions:
  - PI2023000465 “Method of Preparing a Double-Coated Screen-Printed Electrode and the Use Thereof”
  - PI2023002953 “A Detection Reagant and a Method for Detecting SARS-CoV-2”
- Copyright submissions:
  - LY2023W00606 “NACOTS software architecture for COVID-19 diagnosis”
  - LY2023W02113 “Dynamic Baseline Algorithm for Peak Detection in COVID-19 Diagnosis Using NACOTS Software”
  - LY2023W02114 “NACOTS readout and heater circuit for COVID-19 diagnosis”
  - LY2023W02115 “NACOTS heater controller system for COVID-19 sensor”
  - “NACOTS board packaging for COVID-19 sensor” (submitted to MyIPO)
  - “NACOTS software Source Code for COVID-19 Diagnosis” (submitted to MyIPO)

UNIVERSITI TEKNOLOGI MARA

الجامعة الإسلامية العالمية ماليزيا
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA
Garden of Knowledge and Virtue

IMR
INSTITUTE FOR MEDICAL RESEARCH MALAYSIA

Thank you