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Kiran Shrestha

Career Interests

- Diagnostics system development
- Micro/nano fabrication
- Optics / photonics
- Flexible bio/ sensors /actuators
- Point-of-care diagnostics
- Bio-electronic system development

Education and Research Experiences

M.S. & PhD in Biophysics, Sungkyunkwan University

Institute of Quantum Biophysics, Department of Biophysics

09/2019 – 08/2024

Dissertation

Photothermal, rapid, low-cost polymerase chain reaction platform for point-of-care diagnostics

Suwon, Korea

Major Achievements

Diagnostics:
- Developed 15 min sample to answer RT-qPCR-based COVID-19 detection point-of-care device

Micro/nano fabrication:
- Large scale nano-pattern by roll-to-roll imprinting
- Micro-pattern and dPCR microfluidic chip fabrication by photolithography

Flexible Bio-sensors development:
- pH monitor based on polyaniline
- Flexible temperature sensor tag
- Real-time bacteria sensor development

Bio-electronic system development:
- Developed mass-producible PCR photothermal cycler with 23 °C/s heating rate
- Developed 16x RT-qPCR device by innovating off-axis optical fluorescence detection method

M.S. in Printed Electronics, Sunchon National University

Department of Printed Electronic Engineering

02/2017 – 03/2019

Dissertation: *Si-based interfaces to match with printed electronic devices*

Suncheon, Korea

Major Achievements

Flexible sensors development:
- NFC based flexible pH, temperature development
- NFC antenna and hybrid circuit development

Printed electronic system development:
- Developed printed and flexible temperature & pH sensors food safety monitoring
- Innovated low-power flexible circuits NFC-based sensors and authentication tags
- Device development for printed flexible electronic circuits and sensor

Eijkman Molecular Biology Research Center (now Exeins Health Initiative)

Collaborative research with Emerging Virus Research Unit (EVRU)

11/2021 – 01/2022

Major Achievements

- Implementation of MEDIC-PCR device for rapid COVID-19 detection in Indonesia

Jakarta, Indonesia

M.S. Visiting Researcher, University of California San Diego

Prof. Yu-Hwa Lo's group, Jacobs School of Engineering

04/2017 – 08/2017

Major Achievements

- Developed NFC pH sensor for real-time cancer cell monitoring

San Diego, US

Electronic Hardware Design Engineer, Real Time Solutions Pvt.

Research and Development Department

02/2014 – 05/2016

Major Responsibilities

- Embedded system development with an extremely low power budget
- Datalogger and communication modules development for M2M communication
- Develop analog front ends for sensors and communication protocol implementation

Lalitpur, Nepal

Bachelor's degree in Electronics & Communication Engineering, Tribhuvan University

Department of Printed Electronic Engineering

Major Achievements

- Fuzzy logic implementation in 8-bit controller for temperature control
- Implementation of PS2 interface and video interface in 8-bit controller
- 4-bit wireless channel implementation using 433 MHz transceiver

02/2010 – 02/2014

Lalitpur, Nepal

Skills

English - TOEIC 965/990 **Korean -** TOPIK II 5/6

Bio-related

- Experience with Infectious disease (RT-qPCR, dPCR, gel electrophoresis etc.) diagnosis process
- Experience in RT-qPCR, dPCR, LAMP assay
- Operation of qPCR device, clean bench, clean room, basic immunoassay and cell culture.
- Point of care infectious disease diagnosis device development: electronics, microfluidics, simulation
- Nano/ Micro fabrications: SU8 photolithography, laser, soft lithography, 3D printing, roll-to-roll imprinting, deposition
- Microfluidic chip and device design in Inventor, Fusion 360, Solidworks and AutoCad
- Microfluidic simulation in COMSOL and Autodesk CFD
- Chemical lab, bio-lab and electronics lab experience for 8 years

Sensor & electronics-related

- Hands on roll-to-roll, inkjet printing, screen printing, 3D printing, thermal deposition
- Electronic design, schematic design and PCB design in Altium Designer and Lab View
- Firmware development in C, C++, micro python for 8, 32-bit controller using RTOS
- Software development with sensor logging and device control using C#, VB, Python, MATLAB
- NFC antenna design and wireless sensor network implementation
- Electronic test tools, network analyzers, oscilloscope, semiconductor analyzers, function generators etc.

Others

- Measurement devices: Spectrometer, Cyclic voltammetry, Surface profile meter,
- Laboratory safety management electrical, electronic, chemical and basic
- Guiding PhD and master's students (currently guiding 3 students)

Professional experiences

Post Undergraduate Researcher
Printed IC lab, Department of Printed Electronics Engineering, Sunchon National University — *2016/10 – 2017/02* — *Suncheon, Korea*
- Development of NFC sensor platform for temperature sensor

Post Graduate Researcher
Printed IC lab, Department of Printed Electronics Engineering, Sunchon National University — *2019/03 – 2019/08* — *Suncheon, Korea*
- Development of NFC-based QR code driver using printed thin film transistors

Electronics Circuit Instructor
Kantipur Engineering College, Tribhuvan University — *2015 , 2016* — *Lalitpur, Nepal*
- Provided 30+ hours of bare metal programming on At89s52, AtMega32, AtMega328 & Arduino

Undergraduate lecturer
Kantipur Engineering College, Tribhuvan University — *2015/11 – 2016/08* — *Lalitpur, Nepal*
- Lectured undergraduate student two semesters Digital logic and Embedded systems

PCR-related publications

Kiran Shrestha*, et al., and G. Cho
Infectious disease diagnostic device with multiplexed rapid and efficient qPCR assays on a multi-target PCR chip: idream-qPCR — *Revision Microsyst Nanoeng 2025*

Kiran Shrestha*, et al., and G. Cho, LP. Lee
Mobile efficient diagnostics of infectious diseases via on-chip RT-qPCR: MEDIC-PCR — *Adv. Sci. 2023*

Kiran Shrestha*, et al., and G. Cho
Plasmonic materials and manufacturing methods for rapid and sustainable thermal cycler for PCR — *Mater. Today Adv. 2023*

I Kim, H Kim, M Go, S Lee, D D Nguyen, S Kim, **Kiran Shrestha**, et. al., and G. Cho et. al., LP. Lee
Ultrafast Metaphotonic PCR Chip with Near-Perfect Absorber — *Adv. Mater. 2024*

H. Jiyeon, A M Tiara, K Seongryeong, F G Morales, **Kiran Shrestha** et. al. and G. Cho
Nanocomposite-based PCR Reactors to Enhance Thermal Rate and Fluorescence Intensity in Hand- held qPCR Device — *J Nanobiotechnol 2025*

Flexible sensor/electronic-related publications

Sajjan Parajuli , Younsu Jung, Sagar Shrestha, Jinhwa Park, Chanyeop Ahn, **Kiran Shrestha**, et. al., Taik-Min Lee, SoYoung Kim, Gyoujin Cho
Tailoring Threshold Voltage of Roll-to-Roll Printed Carbon Nanotube Thin Film Transistors for Realizing 4-bit Arithmetic and Logic Unit — *npjFlexelectron 2024*

Sun J, S. Parajuli, **Kiran Shrestha*,** et al., and G. Cho — *Adv. Mater. Technol. 2022*

Printed Four Key-Device Units for Unified Platform of Wireless Anti-Counterfeiting Label to Bridge in Blockchain

Kiran Shrestha*, et al., and G. Cho — *Flex. Print. Electron. 2021*
Wireless pH-logger label for intelligent food packaging

Koirala GR, **Kiran Shrestha,** et al., and G. Cho — *Adv Mater Technol. 2021*
A Printable Thin Film-Based Digital Peristaltic Sticker-Pump for a Simple and Robust Integration into Microfluidics

Maskey BB, **Kiran Shrestha**, et al., and G. Cho — *RSC Adv. 2020*
Proving the robustness of a PEDOT:PSS-based thermistor: Via functionalized graphene oxide-poly(vinylidene fluoride) composite encapsulation for food logistics

Maskey BB, Sun J, **Kiran Shrestha**, et al., and G. Cho — *IEEE Sens J. 2020*
A Smart Food Label Utilizing Roll-to-Roll Gravure Printed NFC Antenna and Thermistor to Replace Existing "Use-By" Date System.

J. Sun, H. Park, J. Park, **Kiran Shrestha**, et al., and G. Cho — *Dig. Tech. Pap. - SID Int. Symp., 2022*
R2R gravure printed flexible carbon nanotube-based TFT active matrixes and its flexible display application

Cho, G., Parajuli, S., Park, J., Shrestha, S., **Kiran Shrestha**, Jung, Y., & Sun, J. F. and G. Cho — *IDW, 149 2021*
A way of realizing display of things through a Roll-to-Roll gravure printed TFT-Active matrix.

Park H, Sun J, Jung Y, Park J, Maskey BB**, Kiran Shrestha**, et al., and G. Cho — *Adv Electron Mater. 2020*
The First Step towards a R2R Printing Foundry via a Complementary Design Rule in Physical Dimension for Fabricating Flexible 4-Bit Code Generator.

Jung Y, Kale AM, Park J, Park H, Sun J, Koirala GR, **Kiran Shrestha**, et al., and G. Cho — *Macromol Mater Eng. 2020*
Improving the Stability of R2R Printed 1-Bit Code Generator through Spin-Coated Multilayer-Encapsulation Method.

Y. Jung, J. Park, J. Sun, H. Park, S. Parajuli, S. Shrestha, **Kiran Shrestha**, et al., and G. Cho — *Adv. Mater. Technol. 2022*
Roll-to-Roll Gravure-Printed Carbon Nanotube-based Transistor Arrays for a Digital Column Chromatograph.

Y. Jung, S. Shrestha, N. Lim, H. Park, J. Sun, J. Park, S. Parajuli, **Kiran Shrestha,** et al., and G. Cho — *Adv. Eng. Mater. 2022*
A Printed Wireless Triangle-Wave Generator via a Smartphone.

**published as first/shared first author*

Patents

Roll-to-roll printed near infrared nano-antenna based system for continuous inline ultra-fast detecting nucleic acid based		*WO2022235062A1 KR20220150501A*
NFC QR code label for preventing forgery and falsification and method for producing NFC QR code label		*US11475265B2 WO2020130188A1 KR102140312B1*
Method for manufacturing printed super capacitor provided in NFC tag, and method for manufacturing NFC tag comprising printed super capacitor		*WO2020130186A1 KR102207729B1*
Method for manufacturing flexible thermistor, method for manufacturing temperature sensor comprising flexible thermistor, and temperature sensor comprising flexible thermistor		*WO2019112100A1 KR102060384B1*
Temperature sensor tag preparation method using roll-to-roll gravure printing		*WO2020158981A1 KR102205001B1*
Flexible NFC temperature sensor tag and method for operating flexible NFC temperature tag		*WO2018155757A1 KR102052345B1*
Flexible NFC sensor tag and method for manufacturing flexible NFC sensor tag		*WO2018155756A1 KR102002430B1*
Room temperature roll-to-roll printing system for continuous PCR mini wells and microfluidic chip using PDMS	*pending*	*10-2022-0022160*
Anti-fog technology of PCR film for fluorescence validation of roll-to-roll continuous PCR	*pending*	*10-2022-0019469*
Absorption, fog, evaporation and bubble free PCR technology for fluorescence validation	*pending*	*10-2022-0125982*
3 U (Ultra low cost-ultra fast-ultra-accuracy) PCR equipment using electron-phonon coupling	*pending*	*10-2022-0017891*
PDMS based PCR well plate with improved adhesion with cover film to prevent external contamination during PCR	*pending*	*10-2022-0159151*
Metal filter mesh electrode based Real-time detection sensor for pathogenic organism from flow liquid		*10-2023-0086485*
Polymer-based partitioning technology for easy to use microfluidic chip-based digital PCR	*pending*	*10-2022-0159152*

Major work experience

Bio *2020~2024*

Photothermal RT-qPCR thermal cycler development for infectious disease detection (COVID-19)

- RT-qPCR assay and experiment, experimental design and characterizing device
- Design of control systems for multiple Photonic RT-qPCR devices
- Development of 16x photothermal cycler for PCR using non-contact temperature sensor
- Develop single to 64 LED-based photothermal RT-qPCR for rapid temperature cycles

Real-time fluorescence intensity measurement device and software development

- Development of multiplexed fluorescence readers for photothermal devices
- Developed software to calculate the fluorescence intensity by image processing single to 20K spots.

Microfluidic Chip fabrication

- Fabrication of plasmonic chips, microfluidic chips using laser, imprinting, photolithography, 3D print
- Digital PCR microfluidic chip with 38K partition using exosome biomarkers for Alzheimer's detection
- Multiplexed RT-qPCR tests and data analysis

Bio-sensor Interface development

- Realtime P. Gingivalis bacteria quantification using a capacitive sensor from the oral irrigator

Mechanical designs

- Designed an inline web cutter for the R2R printing system to cut PET during imprinting
- Designed laser-assisted imprinting mold alignment system for the R2R system
- Cleanroom design and building for R2R printing, Volume = 95.8m^3
- Developed customized test jigs for photothermal heat conversion tests and PCR with micro-precision

Flexible electronics *2022~2024*

Silicon interface and emulator design for flexible printed computer

- Designed signal conditioners, repeaters, and amplifiers for printed digital circuits
- Emulated memory, ALU, etc. for the development and tests of printed digital circuits
- Developed customized test jigs for printed circuit tests and measurements

Development of NFC-based sensor platform *2017~2020*

- Fabrication and test of NFC-based printed pH sensor, temperature with Si MCU
- Developed jigs and platforms for NFC antenna automated tests
- Flexible circuit development and tests for printed sensors
- Circuit layout design for flexible roll-to-roll printed NFC QR code label

Active-matrix driver for printed e-paper-based digital signage and robot skin *2017~2018*

Electronics

Datalogger, highly integrated the following features in 155mm x 104mm *2014~2016*

- 6 layered PCB, hi-speed signals
- 3x Full duplex UART
- 2 Simplex RS485
- 1 Full duplex RS485
- Integrated 1Gb Flash, MicroSD, 2 Mb SPI flash,1MB SDRAM

GSM Communication module, using impedance control range improved 2folds

- Dual SIM support featuring TELIT GL865 modem
- Low power design with 0.6 mA (Ideal Mode)
- RF, EMI, and Impedance controlled PCB artwork

GSM, CDMA, and IRIDIUM (satellite) communication module

- Arm32 bits efm32g series and ZTE modem with low power consumption doubling battery life

Development Boards (internal use) *2014~2016*

- PIC18FXK80 family dev. board
- Jennic JN5148 MX Zigbee dev. board
- Bosch BNO055 9° freedom dev. board
- Bosch BMP180 and Freescale MPL115A pressure transducer dev. board
- Semtech LoRa dev. Board with EFM32GG series

Protocol Converter Protocol Converter

- Ultra-low power sleep mode

USB-to-UART Protocol Converter

- Selectable TTL, RS232, and RS485

20A, 24 volts Solar Charge Controller

- Reverse Protection in input
- Transients and surge protection
- Short circuit protection in output and input
- Auto 12v and 25v system detection

5V 5A output buck regulator, 12v DC input

- Low cost, switching controller and switch – MC34063 and 2N3055

300W Class D amplifier with NXP TDA8950 and achieved 130dB

100W Class D amplifier with IR4301

Seismic Monitoring System for early earthquake detection

- LPC4088 32-bit Arm M4, Ethernet, micro-SD
- 2 Gb flash, 32-bit ADC
- Designed especially for seismometers
- Differential channel input up to 20v peak-to-peak

Three-way damper controller

Isolated 500v battery bank monitoring with RS485 interface

Undergraduate projects

Arduino-based mini-computer (Top project in a national event, LOCUS 2013) *~2013*

- Interface TV AV with Arduino for a low-cost computer
- Interface PS2 keyboard with Arduino low-cost computer input

Fuzzy logic-based egg incubator (Undergraduate final year project)

- Implemented Fuzzy logic in an 8-bit micro-controller for a temperature control system
- Data logging of temperature, and humidity sensors
- Manual design of capacitive touch interface and algorithm

Accelerometer sensor-based wireless robot control (Undergraduate project)

- Software implementation of IIC on AT89s52
- Wireless Transmission of 8-bit data with a 4-bit wireless channel

Awards

PhD Scholarship for excellent students in the STEM field in all semesters — *2019-2024, Korea*
Suwon, Sungkyunkwan University

Best poster for presenting novel infectious disease detection RT-qPCR device in WISDOM conference — *2024, Korea*
Seoul, Sungkyunkwan University

BK21 Research Matters Fellowship for research on COVID-19 detection in 15min — *2021, Korea*
Suwon, Sungkyunkwan University

BK21plus program is the best poster for research on NFC based authentication system — *2019, Korea*
Sunchon National University

Academic excellence scholarship for a highly performing student in master's degree — *2017, Korea*
Sunchon National University

Excellence language scholarship for securing a high score on the TOEIC test — *2017, Korea*
Sunchon National University

National electronic hardware design competition for developing low-cost computers for rural areas — *2013, Nepal*
Award-winning

Academic excellence scholarship during undergraduate degree — *2010~2014, Nepal*
Tribhuvan University

International conferences, presentations

R2R Gravure Printed NFC QR-Code Label to Prevent Counterfeits. (Oral presentation**)** — *September 2018, Changzhou China*
International Conference on Flexible and Printed Electronics

Flexible NFC Sensor Platform for Printed Sensor Application. (Oral presentation**)** — *September 2017, Jeju, South Korea*
International Conference on Flexible and Printed Electronics

Roll Coated Flexible PEDOT:PSS Electrodes for NFC-pH Sensor. (Poster) — *September 2017, Jeju, South Korea*
International Conference on Flexible and Printed Electronics

R2R Gravure Printed NFC activated QR Code Label for Authentication. (Poster) — *January 2019, Suncheon, Korea*
Sunchon National University

R2R Gravure Printed NFC Activated QR Code Label for cashierless store. (Poster) — *January 2019, Tokyo, Japan*
Nanotech International Exhibition and Conference

Flexible NFC tag for food packaging with printed antenna and temperature sensor with Si-chip as RF front end. (Poster) — *July 2018, Busan, Korea*
International Conference on Science and Technology of Synthetic Metal

Roll-to-roll printed Mini well for Efficient Detection of Infectious diseases with Convenient (MEDIC) RT-qPCR device. (Poster) — *June 2022, Suwon, Korea*
International Conference on the Science and Applications of Nanotubes and Low-Dimensional Materials

Roll-to-Roll Gravure with Imprinter as a Sustainable Manufacturing Method for Bioelectronics. (Poster) — *October 2022, Jeju, Korea*
International Conference on Flexible and Printed Electronics

Early Diagnosis of Neurodegenerative Diseases via Plasmonic Digital PCR. (Poster) — *July 2023, Suwon, Korea*
World Innovation Summit for Neurodegenerative Diseases: Opportunities and challenges in Medicine (WISDOM)

Multiplex, Expedited, Diagnostic Device with Chip-based Assay for Infectious Illness: MEDICAL RT-qPCR (Poster) — *July 2024, Seoul, Korea*
World Innovation Summit for neurodegenerative Diseases: Opportunities and challenges in Medicine (WISDOM)