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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 cyler 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
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### 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 <b>Printed IC lab, Department of Printed Electronics Engineering, Suncheon National University</b>	2016/10 – 2017/02	Suncheon, Korea
▪ Development of NFC sensor platform for temperature sensor		
Post Graduate Researcher <b>Printed IC lab, Department of Printed Electronics Engineering, Suncheon National University</b>	2019/03 – 2019/08	Suncheon, Korea
▪ Development of NFC-based QR code driver using printed thin film transistors		
Electronics Circuit Instructor <b>Kantipur Engineering College, Tribhuvan University</b>	2015 , 2016	Lalitpur, Nepal
▪ Provided 30+ hours of bare metal programming on At89s52, AtMega32, AtMega328 & Arduino		
Undergraduate lecturer <b>Kantipur Engineering College, Tribhuvan University</b>	2015/11 – 2016/08	Lalitpur, Nepal
▪ Lectured undergraduate student two semesters Digital logic and Embedded systems		

## PCR-related publications

<b>Kiran Shrestha*</b> , et al., and G. Cho <i>Infectious disease diagnostic device with multiplexed rapid and efficient qPCR assays on a multi-target PCR chip: idream-qPCR</i>	Revision Microsyst Nanoeng 2025
<b>Kiran Shrestha*</b> , et al., and G. Cho, LP. Lee <i>Mobile efficient diagnostics of infectious diseases via on-chip RT-qPCR: MEDIC-PCR</i>	Adv. Sci. 2023
<b>Kiran Shrestha*</b> , et al., and G. Cho <i>Plasmonic materials and manufacturing methods for rapid and sustainable thermal cyclers for PCR</i>	Mater. Today Adv. 2023
I Kim, H Kim, M Go, S Lee, D D Nguyen, S Kim, <b>Kiran Shrestha</b> , et. al., and G. Cho et. al., LP. Lee <i>Ultrafast Metaphotonic PCR Chip with Near-Perfect Absorber</i>	Adv. Mater. 2024
H. Jiyeon, A M Tiara, K Seongryeong, F G Morales, <b>Kiran Shrestha</b> et. al. and G. Cho <i>Nanocomposite-based PCR Reactors to Enhance Thermal Rate and Fluorescence Intensity in Hand- held qPCR Device</i>	J Nanobiotechnol 2025

## Flexible sensor/electronic-related publications

Sajjan Parajuli , Younsu Jung, Sagar Shrestha, Jinhwa Park, Chanyeop Ahn, <b>Kiran Shrestha</b> , et. al., Taik-Min Lee, SoYoung Kim, Gyoujin Cho <i>Tailoring Threshold Voltage of Roll-to-Roll Printed Carbon Nanotube Thin Film Transistors for Realizing 4-bit Arithmetic and Logic Unit</i>	npjFlexelectron 2024
Sun J, S. Parajuli, <b>Kiran Shrestha*</b> , et al., and G. Cho	Adv. Mater. Technol. 2022

**Kiran Shrestha\***, et al., and G. Cho  
Wireless pH-logger label for intelligent food packaging

Flex. Print. Electron.  
2021

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

Adv Mater Technol.  
2021

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

RSC Adv.  
2020

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

IEEE Sens J.  
2020

J. Sun, H. Park, J. Park, **Kiran Shrestha**, et al., and G. Cho  
R2R gravure printed flexible carbon nanotube-based TFT active matrixes and its flexible display application

Dig. Tech. Pap. - SID  
Int. Symp., 2022

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

IDW, 149  
2021

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

Adv Electron Mater.  
2020

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

Macromol Mater  
Eng. 2020

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

Adv. Mater. Technol.  
2022

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

Adv. Eng. Mater.  
2022

\*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

<b>Bio</b> <b>Photothermal RT-qPCR thermal cycler development for infectious disease detection (COVID-19)</b> <ul style="list-style-type: none"><li>▪ RT-qPCR assay and experiment, experimental design and characterizing device</li><li>▪ Design of control systems for multiple Photonic RT-qPCR devices</li><li>▪ Development of 16x photothermal cycler for PCR using non-contact temperature sensor</li><li>▪ Develop single to 64 LED-based photothermal RT-qPCR for rapid temperature cycles</li></ul> <b>Real-time fluorescence intensity measurement device and software development</b> <ul style="list-style-type: none"><li>▪ Development of multiplexed fluorescence readers for photothermal devices</li><li>▪ Developed software to calculate the fluorescence intensity by image processing single to 20K spots.</li></ul> <b>Microfluidic Chip fabrication</b> <ul style="list-style-type: none"><li>▪ Fabrication of plasmonic chips, microfluidic chips using laser, imprinting, photolithography, 3D print</li><li>▪ Digital PCR microfluidic chip with 38K partition using exosome biomarkers for Alzheimer's detection</li><li>▪ Multiplexed RT-qPCR tests and data analysis</li></ul> <b>Bio-sensor Interface development</b> <ul style="list-style-type: none"><li>▪ Realtime P. Gingivalis bacteria quantification using a capacitive sensor from the oral irrigator</li></ul> <b>Mechanical designs</b> <ul style="list-style-type: none"><li>▪ Designed an inline web cutter for the R2R printing system to cut PET during imprinting</li><li>▪ Designed laser-assisted imprinting mold alignment system for the R2R system</li><li>▪ Cleanroom design and building for R2R printing, Volume = 95.8m<sup>3</sup></li><li>▪ Developed customized test jigs for photothermal heat conversion tests and PCR with micro-precision</li></ul>	2020~2024
<b>Flexible electronics</b> <b>Silicon interface and emulator design for flexible printed computer</b> <ul style="list-style-type: none"><li>▪ Designed signal conditioners, repeaters, and amplifiers for printed digital circuits</li><li>▪ Emulated memory, ALU, etc. for the development and tests of printed digital circuits</li><li>▪ Developed customized test jigs for printed circuit tests and measurements</li></ul> <b>Development of NFC-based sensor platform</b> <ul style="list-style-type: none"><li>▪ Fabrication and test of NFC-based printed pH sensor, temperature with Si MCU</li><li>▪ Developed jigs and platforms for NFC antenna automated tests</li><li>▪ Flexible circuit development and tests for printed sensors</li><li>▪ Circuit layout design for flexible roll-to-roll printed NFC QR code label</li></ul> <b>Active-matrix driver for printed e-paper-based digital signage and robot skin</b>	2022~2024
<b>Electronics</b> <b>Datalogger, highly integrated the following features in 155mm x 104mm</b> <ul style="list-style-type: none"><li>▪ 6 layered PCB, hi-speed signals</li><li>▪ 3x Full duplex UART</li><li>▪ 2 Simplex RS485</li><li>▪ 1 Full duplex RS485</li><li>▪ Integrated 1Gb Flash, MicroSD, 2 Mb SPI flash, 1MB SDRAM</li></ul> <b>GSM Communication module, using impedance control range improved 2folds</b> <ul style="list-style-type: none"><li>▪ Dual SIM support featuring TELIT GL865 modem</li><li>▪ Low power design with 0.6 mA (Ideal Mode)</li><li>▪ RF, EMI, and Impedance controlled PCB artwork</li></ul> <b>GSM, CDMA, and IRIDIUM (satellite) communication module</b> <ul style="list-style-type: none"><li>▪ Arm32 bits efm32g series and ZTE modem with low power consumption doubling battery life</li></ul>	2017~2020
<b>Development Boards (internal use)</b> <ul style="list-style-type: none"><li>▪ PIC18FXK80 family dev. board</li><li>▪ Jennic JN5148 MX Zigbee dev. board</li><li>▪ Bosch BNO055 9° Freedom dev. board</li><li>▪ Bosch BMP180 and Freescale MPL115A pressure transducer dev. board</li><li>▪ Semtech LoRa dev. Board with EFM32GG series</li></ul> <b>Protocol Converter Protocol Converter</b> <ul style="list-style-type: none"><li>▪ Ultra-low power sleep mode</li></ul> <b>USB-to-UART Protocol Converter</b> <ul style="list-style-type: none"><li>▪ Selectable TTL, RS232, and RS485</li></ul> <b>20A, 24 volts Solar Charge Controller</b> <ul style="list-style-type: none"><li>▪ Reverse Protection in input</li><li>▪ Transients and surge protection</li><li>▪ Short circuit protection in output and input</li><li>▪ Auto 12v and 25v system detection</li></ul> <b>5V 5A output buck regulator, 12v DC input</b> <ul style="list-style-type: none"><li>▪ Low cost, switching controller and switch – MC34063 and 2N3055</li></ul> <b>300W Class D amplifier with NXP TDA8950 and achieved 130dB</b> <b>100W Class D amplifier with IR4301</b> <b>Seismic Monitoring System for early earthquake detection</b> <ul style="list-style-type: none"><li>▪ LPC4088 32-bit Arm M4, Ethernet, micro-SD</li><li>▪ 2 Gb flash, 32-bit ADC</li><li>▪ Designed especially for seismometers</li><li>▪ Differential channel input up to 20v peak-to-peak</li></ul> <b>Three-way damper controller</b> <b>Isolated 500v battery bank monitoring with RS485 interface</b>	2017~2018
<b>Undergraduate projects</b> <b>Arduino-based mini-computer (Top project in a national event, LOCUS 2013)</b> <ul style="list-style-type: none"><li>▪ Interface TV AV with Arduino for a low-cost computer</li><li>▪ Interface PS2 keyboard with Arduino low-cost computer input</li></ul> <b>Fuzzy logic-based egg incubator (Undergraduate final year project)</b> <ul style="list-style-type: none"><li>▪ Implemented Fuzzy logic in an 8-bit micro-controller for a temperature control system</li><li>▪ Data logging of temperature, and humidity sensors</li><li>▪ Manual design of capacitive touch interface and algorithm</li></ul> <b>Accelerometer sensor-based wireless robot control (Undergraduate project)</b> <ul style="list-style-type: none"><li>▪ Software implementation of IIC on AT89s52</li><li>▪ Wireless Transmission of 8-bit data with a 4-bit wireless channel</li></ul>	2014~2016
	~2013

## Awards

PhD Scholarship for excellent students in the STEM field in all semesters Suwon, Sungkyunkwan University	2019-2024, Korea
Best poster for presenting novel infectious disease detection RT-qPCR device in WISDOM conference Seoul, Sungkyunkwan University	2024, Korea
BK21 Research Matters Fellowship for research on COVID-19 detection in 15min Suwon, Sungkyunkwan University	2021, Korea
BK21plus program is the best poster for research on NFC based authentication system Suncheon National University	2019, Korea
Academic excellence scholarship for a highly performing student in master's degree Suncheon National University	2017, Korea
Excellence language scholarship for securing a high score on the TOEIC test Suncheon National University	2017, Korea
National electronic hardware design competition for developing low-cost computers for rural areas Award-winning	2013, Nepal
Academic excellence scholarship during undergraduate degree Tribhuvan University	2010~2014, Nepal

## International conferences, presentations

<b>R2R Gravure Printed NFC QR-Code Label to Prevent Counterfeits. (Oral presentation)</b> <i>International Conference on Flexible and Printed Electronics</i>	September 2018, Changzhou China
<b>Flexible NFC Sensor Platform for Printed Sensor Application. (Oral presentation)</b> <i>International Conference on Flexible and Printed Electronics</i>	September 2017, Jeju, South Korea
<b>Roll Coated Flexible PEDOT:PSS Electrodes for NFC-pH Sensor. (Poster)</b> <i>International Conference on Flexible and Printed Electronics</i>	September 2017, Jeju, South Korea
<b>R2R Gravure Printed NFC activated QR Code Label for Authentication. (Poster)</b> <i>Suncheon National University</i>	January 2019, Suncheon, Korea
<b>R2R Gravure Printed NFC Activated QR Code Label for cashierless store. (Poster)</b> <i>Nanotech International Exhibition and Conference</i>	January 2019, Tokyo, Japan
<b>Flexible NFC tag for food packaging with printed antenna and temperature sensor with Si-chip as RF front end. (Poster)</b> <i>International Conference on Science and Technology of Synthetic Metal</i>	July 2018, Busan, Korea
<b>Roll-to-roll printed Mini well for Efficient Detection of Infectious diseases with Convenient (MEDIC) RT-qPCR device. (Poster)</b> <i>International Conference on the Science and Applications of Nanotubes and Low-Dimensional Materials</i>	June 2022, Suwon, Korea
<b>Roll-to-Roll Gravure with Imprinter as a Sustainable Manufacturing Method for Bioelectronics. (Poster)</b> <i>International Conference on Flexible and Printed Electronics</i>	October 2022, Jeju, Korea
<b>Early Diagnosis of Neurodegenerative Diseases via Plasmonic Digital PCR. (Poster)</b> <i>World Innovation Summit for Neurodegenerative Diseases: Opportunities and challenges in Medicine (WISDOM)</i>	July 2023, Suwon, Korea
<b>Multiplex, Expedited, Diagnostic Device with Chip-based Assay for Infectious Illness: MEDICAL RT-qPCR (Poster)</b> <i>World Innovation Summit for neurodegenerative Diseases: Opportunities and challenges in Medicine (WISDOM)</i>	July 2024, Seoul, Korea

## References

<b>Prof. Gyoujin Cho</b> <i>PhD. Advisor</i>	<i>Vice Director of IQB Department of Biophysics, <b>Sungkyunkwan University</b></i>	Phone: +82-10-4145-3585 E: gcho1004@skku.edu
<b>Prof. Luke P. Lee</b> <i>PhD. Co. Advisor and Committee</i>	<i>Harvard Medical School, Department of Medicine Brigham Women's Hospital, <b>Harvard University</b></i>	Phone: +1-858-231-9908 E: <a href="mailto:lplee@bwh.harvard.edu">lplee@bwh.harvard.edu</a>
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