

# M SHIFAT HOSSAIN

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**Github:** [github.com/ShifatHossain](https://github.com/ShifatHossain)

## Education

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### PHD IN COMPUTER ENGINEERING | AUGUST 2022 - PRESENT

- **Institution:** University of Central Florida, Orlando, FL, USA
- **Research Interests:** Explainable AI, Machine Learning, Image processing, Signal processing, Biomedical signal processing .

### MASTERS OF SCIENCE IN ELECTRONICS ENGINEERING | MARCH 2019 - FEBRUARY 2021

- **Institution:** Kookmin University, Seoul, Korea      • **CGPA:** 4.5/4.5
- **Major:** Electronics Engineering
- **Research Interests:** Biomedical signal processing, Machine Learning, Signal processing, Digital image processing.
- **Thesis:** Glycated Hemoglobin Estimation Based on Photon Diffusion Theory

### BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONIC ENGINEERING (B. SC. ENG. IN EEE) | MARCH 2013 - MAY 2017

- **Institution:** Khulna University of Engineering & Technology
- **Department:** Department of Electrical and Electronic Engineering (EEE)
- **Thesis:** Physical Source Based Sound Signal Extraction from Mixed Audio Signals Using Spectral Analysis

## Technical and Personal Skills

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**Programming Languages:** Python, C/C++ (GCC/LLVM Clang), GNU Octave/MATLAB, Java.

**Deep Learning Tools:** Pytorch, Keras, TensorFlow.

**Platform, Frameworks, and IDE:** Android (Android Studio, Java), VSCode, OpenGL.

**Circuit Designing, Simulation and PCB Designing:** Kicad, Eagle Cad, Proteus, Designsoft TINA, Diptrace, Cadence Virtuoso.

**Hardware Prototype Designing:** Arduino, ESP32, Raspberry Pi, Atmel AVR.

**Graphics Programming, Model Designing and Simulation:** FreeCad, Blender, Unity Game Engine.

## Professional Experiences

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### GRADUATE RESEARCH ASSISTANT | UNIVERSITY OF CENTRAL FLORIDA | AUGUST 2022 – PRESENT

**Company Name:** University of Central Florida – AI and Emerging Computing Lab

**Address:** 235, L3Harris Engineering Center, University of Central Florida, 4000 Central Florida Blvd. Orlando, Florida, 32816, USA

**Telephone:** +1 407-823-4766

**Responsibilities:**

- Studying on Explainable AI and ML model security and trust.

### RESEARCHER | KOOKMIN UNIVERSITY | MARCH 2021 – JULY 2022

**Company Name:** Kookmin University Industry-Academic Cooperation Foundation

**Address:** Kookmin University, 77 Jeongneung-ro, Seongbuk-gu, Seoul, Korea

**Telephone:** +82 2-910-5073

**Responsibilities:**

- Studying on estimation of blood contents based on gray box models and Monte Carlo simulations.
- Develop algorithms and devices to achieve the measurements.

**GRADUATE RESEARCH ASSISTANT | KOOKMIN UNIVERSITY | MARCH 2019 – FEBRUARY 2021**

**Company Name:** Kookmin University – Multimedia, Communication, and Signal Processing Lab

**Address:** 506, Future Hall, Building 7, Kookmin University, 77 Jeongneung-ro, Seongbuk-gu, Seoul, Korea

**Telephone:** +82 2-910-5073

**Responsibilities:**

- Studying on biomedical signal processing and image processing systems.
- Developed hardware solutions for different biomedical applications.

**LECTURER | DAFFODIL INTERNATIONAL UNIVERSITY | SEPTEMBER 2018 – FEBRUARY 2019**

**Company Name:** Daffodil International University – Department of Electrical and Electronics Engineering

**Address:** Daffodil International University, Daffodil Smart City, Ashulia, Dhaka, Bangladesh

**Telephone:** +88 02-4811-1639

**Responsibilities:**

- Teaching undergraduate students on Microprocessors and Interfacing, Control Systems, Electronic Devices and Circuit Theory, Random Signals and Processes, Power System Protection.

**FREELANCE SOFTWARE DEVELOPER | BANGLADESH INSTITUTE OF ICT IN DEVELOPMENT (BIID) | MAY 2015 – MAY 2016**

**Company Name:** Bangladesh Institute of ICT in Development (BIID)

**Address:** Bangladesh Institute of ICT in Development (BIID), House No. 174, Level-2, Apt.B3, Road No. 02, Mohakhali DOHS, Dhaka- 1206 Bangladesh

**Telephone:** +88 02-8714-169

**Responsibilities:**

- Designing a web based agricultural data repository for the Bangladesh Institute of ICT in Development (BIID) in ASP.NET.

**Publications**

**No. of citations:** 222 (February 21, 2024)

**Patents (6)**

- Ki-Doo Kim and **Shifat Hossain**, “Noninvasive glyated hemoglobin or blood glucose measurement system and method which use monte-carlo simulation,” WO2022045822A1, Mar. 03, 2022 Accessed: May 23, 2022. [[Online](#)]
- Ki-Doo Kim and **Shifat Hossain**, “Noninvasive hba1c measurement system and method using monte carlo simulation,” KR20220027515A, Mar. 08, 2022 Accessed: May 23, 2022. [[Online](#)]
- Ki-Doo Kim and **Shifat Hossain**, “Noninvasive hba1c measurement system and method thereof,” KR20220027444A, Mar. 08, 2022 Accessed: May 23, 2022. [[Online](#)]
- Ki-Doo Kim and **Shifat Hossain**, “Noninvasive HbA1c Measurement System Using Photon-Diffusion Theory and Method Thereof,” KR20210137769A, Nov. 18, 2021 Accessed: Jan. 26, 2022. [[Online](#)].
- Ki-Doo Kim and **Shifat Hossain**, “System and method for non-invasive measurement of glyated hemoglobin,” WO2021210724A1, Oct. 21, 2021 Accessed: Feb. 09, 2022. [[Online](#)].

- Ki-Doo Kim and **Shifat Hossain**, “Noninvasive HbA1c Measurement System Using the Beer-Lambert law and Method Thereof,” KR20210126952A, Oct. 21, 2021 Accessed: Jan. 26, 2022. [[Online](#)].

## Journals (14)

- C. A. Haque, **S. Hossain**, T.-H. Kwon, H. Kim, and K.-D. Kim, Noninvasive In-Vivo Estimation of Blood-Glucose Concentration Using Beer-Lambert-Based Model, The Korean Institutes of Communications and Information Sciences, vol. 48 (7), pp. 852-867, Jul. 2023. ([Link](#))
- **S. Hossain** and K.-D. Kim, Non-Invasive In Vivo Estimation of HbA1c Using Monte Carlo Photon Propagation Simulation: Application of Tissue-Segmented 3D MRI Stacks of the Fingertip and Wrist for Wearable Systems, Sensors, vol. 23, no. 1, Art. no. 1, Jan. 2023, doi: 10.3390/s23010540. ([Link](#))
- **S. Hossain**, S. Satter, T.-H. Kwon, and K.-D. Kim, “Optical Measurement of Molar Absorption Coefficient of HbA1c: Comparison of Theoretical and Experimental Results,” Sensors, vol. 22, no. 21, Art. no. 21, Jan. 2022, doi: 10.3390/s22218179. ([Link](#))
- **S. Hossain** and K.-D. Kim, “Noninvasive Estimation of Glycated Hemoglobin In-Vivo Based on Photon Diffusion Theory and Genetic Symbolic Regression Models,” IEEE Transactions on Biomedical Engineering, vol. 69, no. 6, pp. 2053–2064, Jun. 2022, doi: 10.1109/TBME.2021.3135305. ([Link](#))
- S. Sen Gupta, **S. Hossain**, and K.-D. Kim, “Recognize the surrounding: Development and evaluation of convolutional deep networks using gammatone spectrograms and raw audio signals,” Expert Systems with Applications, vol. 200, p. 116998, Aug. 2022, doi: 10.1016/j.eswa.2022.116998. ([Link](#))
- M. S. H. Sunny, **S. Hossain**, N. Afroze, M. K. Hasan, E. Hossain, and M. H. Rahman, “Understanding the nonlinear behavior of EEG with advanced machine learning in artifact elimination,” Biomed. Phys. Eng. Express, vol. 8, no. 1, p. 015017, Dec. 2021, doi: 10.1088/2057-1976/ac3f17. ([Link](#))
- **S. Hossain** and K.-D. Kim, “Comparison of Different Wavelengths for Estimating HbA1c and SpO<sub>2</sub> Noninvasively Using Beer-Lambert Law and Photon Diffusion Theory Derived Models,” The Journal of Korean Institute of Communications and Information Sciences, vol. 46, no. 8, pp. 1301–1308, Aug. 2021, doi: 10.7840/kics.2021.46.8.1301. ([Link](#))
- **S. Hossain**, C. A. Haque, and K.-D. Kim, “Quantitative Analysis of Different Multi-Wavelength PPG Devices and Methods for Noninvasive In-Vivo Estimation of Glycated Hemoglobin,” Applied Sciences, vol. 11, no. 15, Art. no. 15, Jul. 2021, doi: 10.3390/app11156867. ([Link](#))
- C. A. Haque, **S. Hossain**, T.-H. Kwon, and K.-D. Kim, “Noninvasive In Vivo Estimation of Blood-Glucose Concentration by Monte Carlo Simulation,” Sensors, vol. 21, no. 14, Art. no. 14, Jan. 2021, doi: 10.3390/s21144918. ([Link](#))
- S. S. Gupta, T.-H. Kwon, **S. Hossain**, and K.-D. Kim, “Towards non-invasive blood glucose measurement using machine learning: An all-purpose PPG system design,” Biomedical Signal Processing and Control, vol. 68, p. 102706, Jul. 2021, doi: 10.1016/j.bspc.2021.102706. ([Link](#))
- **S. Hossain** and K.-D. Kim, “Estimation of Molar Absorption Coefficients of HbA1c in Near UV-Vis-SW NIR Light Spectrum,” The Korean Institutes of Communications and Information Sciences, Jun. 2020. ([Link](#))
- **S. Hossain**, S. S. Gupta, T.-H. Kwon, and K.-D. Kim, “Derivation and Validation of Gray-Box Models to Estimate Noninvasive In-vivo Percentage Glycated Hemoglobin Using Digital Volume Pulse Waveform,” Scientific Reports, Jun. 2021, doi: 10.1038/s41598-021-91527-2. ([Link](#))
- S. S. Gupta, **S. Hossain**, and K.-D. Kim, “HDR-Like Image from Pseudo-Exposure Image Fusion: A Genetic Algorithm Approach,” IEEE Transactions on Consumer Electronics, vol. 67, no. 2, pp. 119–128, May 2021, doi: 10.1109/TCE.2021.3066431. ([Link](#))
- P. P. Banik, **S. Hossain**, T.-H. Kwon, H. Kim, and K.-D. Kim, “Development of a Wearable Reflection-Type Pulse Oximeter System to Acquire Clean PPG Signals and Measure Pulse Rate and SpO<sub>2</sub> with and without Finger Motion,” Electronics, vol. 9, no. 11, Art. no. 11, Nov. 2020, doi: 10.3390/electronics9111905. ([Link](#))

## Conferences (9)

- **M. S. Hossain**, M. R. Ahmed, L. Pullum, S. Jha, and R. Ewetz, “Neuro-Symbolic Representations of 3D Scenes using Universal Scene Description Language,” in Neuro-Symbolic Learning and Reasoning in the era of Large Language Models (NuCLear), 2023. [Accepted for Publication]
- C. A. Haque, **S. Hossain**, T.-H. Kwon, and K.-D. Kim, “Comparison of Different Methods to Estimate Blood Oxygen Saturation using PPG,” in 2021 International Conference on Information and Communication Technology Convergence (ICTC), Oct. 2021, pp. 792–794. doi: 10.1109/ICTC52510.2021.9621142.
- S. S. Gupta, **S. Hossain**, C. A. Haque, and K.-D. Kim, “In-Vivo Estimation of Glucose Level Using PPG Signal,” in 2020 International Conference on Information and Communication Technology Convergence (ICTC), Oct. 2020, pp. 733–736. doi: 10.1109/ICTC49870.2020.9289629.
- **S. Hossain**, T.-H. Kwon, and K.-D. Kim, “Comparison of Different Wavelengths for Estimating SpO<sub>2</sub> Using Beer-Lambert Law and Photon Diffusion in PPG,” in 2019 International Conference on Information and Communication Technology Convergence (ICTC), Oct. 2019, pp. 1377–1379. doi: 10.1109/ICTC46691.2019.8939849.
- Md. S. Haque Sunny, D. Roy Dipta, **S. Hossain**, H. M. Resalat Faruque, and E. Hossain, “Design of a Convolutional Neural Network Based Smart Waste Disposal System,” in 2019 1st International Conference on Advances in Science, Engineering and Robotics Technology (ICASERT), May 2019, pp. 1–5. doi: 10.1109/ICASERT.2019.8934633.
- S. S. Khan, Md. S. H. Sunny, **M. S. Hossain**, E. Hossain, and M. Ahmad, “Nose tracking cursor control for the people with disabilities: An improved HCI,” in 2017 3rd International Conference on Electrical Information and Communication Technology (EICT), Dec. 2017, pp. 1–5. doi: 10.1109/EICT.2017.8275178.
- **S. Hossain**, S. S. Khan, M. S. H. Sunny, and M. Ahmad, “Frequency component grouping based sound source extraction from mixed audio signals using spectral analysis,” in 2017 3rd International Conference on Electrical Information and Communication Technology (EICT), Dec. 2017, pp. 1–6. doi: 10.1109/EICT.2017.8275145.
- Md. S. H. Sunny, E. Hossain, T. N. Mimma, and **S. Hossain**, “An autonomous robot: Using ANN to navigate in a static path,” in 2017 4th International Conference on Advances in Electrical Engineering (ICAEE), Sep. 2017, pp. 291–296. doi: 10.1109/ICAEE.2017.8255369.
- Md. K. Hasan, Md. S. H. Sunny, **S. Hossain**, and M. Ahmad, “User Independency of SSVEP Based Brain Computer Interface Using ANN Classifier: Statistical Approach,” in Recent Advances in Information and Communication Technology Bangladesh Institute of ICT in Development 2017, Cham, 2018, pp. 58–68. doi: 10.1007/978-3-319-60663-7\_6.

## Recent Projects

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- **EXPLAINING COMPLEX MACHINE LEARNING MODELS WITH EXPLAINABLE AI PROCESSES AND FRAMEWORKS (2022-PRESENT)**  
Designed a novel exemplar-based method to explain multi-modal data dependent complex ML models.
- **EMBEDDED WEARABLE DEVICE FOR NONINVASIVE GLYCATED HEMOGLOBIN ESTIMATION (2020-2022)**  
Designed an embedded wearable device to measure the amount of glycated hemoglobin in blood noninvasively.
- **MOBILE CAMERA BASED FINGERTIP DVP SIGNAL ACQUISITION SYSTEM (2019)**  
Developed an Android application to record 3-wavelength Digital Volume Pulse (DVP) signals directly from the mobile camera sensor.

## Honors and Awards

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- Received **ORCGS Doctoral Fellowship** for excellent academic background upon enrollment in the Department of Electrical and Computer Engineering, University of Central Florida as a PhD Student.

- The presentation on the paper titled "Analysis of national patent statistics for Visual-MIMO" received the **best presenter award** at a conference arranged by Kookmin University.
- The poster presentation on the paper titled "Statistical Analysis of IP Documents on "Artificial Neural Network" from Google Patents Database" received the **best presenter award** in an academic congress arranged by Kookmin University.
- **Dr. Fatima Rashid Best Paper Award** was given to the paper titled "n Autonomous Robot: Using ANN to Navigate in a Static Path".
- **Technical Scholarship** was awarded from Khulna University of Engineering and Technology (KUET) for excellence in academic performances.

## Volunteer Experiences

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- Volunteered in a Line-Follower robot competition as a mentor. My overall role was to maintain the rules of the competition and give marks on competitors' robot performance. *(December 2016)*
- Worked as a graphics designer and technical core in the Inter-University Tech Fiesta (IUTF), Khulna University of Engineering & Technology (KUET), a nationwide science and technology competition and research platform. *(January 2016)*
- Volunteered in the International Conference on Electrical Information and Communication Technology (EICT), Khulna, Bangladesh as a technical operator. *(December 2015)*
- In this workshop named "Human Enlightenment and Researching Technical Zone (HERTZ)", we trained the students from beginner to advanced levels of C/C++ programming language. *(June 2014-June 2015)*

## Language Proficiency

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- **Bangla** (Bangladesh, Native)
- **English** (Proficient)
- **Korean** (Beginner)