M SHIFAT HOSSAIN

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Education

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

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

Professional Experiences

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- 1206Bangladesh

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.

Standardized Tests

GRE

Date attended: July 31, 2021

Overall scaled score – 318

Quantitative – 166 (86th percentile),
Verbal – 152 (53rd percentile),
Analytical writing – 4.0 (54th percentile)

IELTS

Date attended: October 30, 2021

Overall – 7.0

Listening – 8.0, **Reading** – 7.0, **Writing** – 6.5, **Speaking** – 7.0

Publications

Patents

- Ki-Doo Kim and **Shifat Hossain**, "Noninvasive glycated 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 glycated 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

- **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_2 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. Sen 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**, 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. Sen 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 SpO2 with and without Finger Motion," Electronics, vol. 9, no. 11, Art. no. 11, Nov. 2020, doi: 10.3390/electronics9111905. (Link)

Conferences

- 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 SpO2 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 TechnoloBangladesh Institute of ICT in Developmentgy 2017, Cham, 2018, pp. 58–68. doi: 10.1007/978-3-319-60663-7_6.

Recent Projects

- **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

- 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

- 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

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