Syed Emad Uddin Shubha

shubha.buet@gmail.com | in/syedshubha | syedshubha.github.io

RESEARCH INTEREST

- Quantum Communication
- Quantum Cryptography
- Quantum Error Correction
- Optics and Photonics
- Quantum Algorithm
- Deep Learning

EDUCATION

Louisiana State University **January 2025 – Present**
Computer Science
Courses: Quantum Technologies, Programming Language Structures
Bangladesh University of Engineering and Technology **February 2017 – May 2022**
B.Sc. in Electrical and Electronic Engineering **CGPA: 3.24/4.00**

RESEARCH EXPERIENCE

Graduate Research Assistant — Louisiana State University, USA January 2025 - Present

- Currently working on a research project, "Increasing Teleportation Fidelity using Stabilizer Code based on Information Entropy Metrics" under Dr. Tasnuva Farheen, where I am using Quantum Discord and Entanglement of Formation as metrics to enhance quantum teleportation. I have presented my progress so far at Q-Net Symposium 2025 by LSU APS Chapter. I am also studying Quantum Machine Learning.

Research Assistant — North South University, Dhaka June 2022 - May 2024

- Engaged in diverse quantum research projects under the supervision of Dr. Mahdy Rahman Chowdhury.
- Working primarily as a researcher and occasionally co-supervising research students.
- Published a high-impact journal article on Quantum Communication (as 1^{st} author) in Heliyon (Q1-indexed). Another paper on Surface Code has been presented at IEEE ICTP 2023. I was also involved in four research projects on quantum cryptography, algorithms, and quantum energy teleportation (the arXiv versions are available).

Undergraduate Research — Bangladesh University of Engineering and Technology (BUET)

- Conducted an undergraduate thesis on quantum communication under the supervision of Dr. Md. Saifur Rahman.
- Conducted research on deep learning in MI - BCI task classification.
- Both of these works were conducted during the undergraduate final year and have been published in IEEE conferences.

PUBLICATIONS

- **JOURNAL PUBLICATION:**

1. **Syed Emad Uddin Shubha**, Md. Saifur Rahman, M.R.C. Mahdy, "Significant improvement of fidelity for encoded quantum bell pairs at long and short-distance communication along with a generalized circuit." Heliyon (Q1-indexed, IF: 4.00), Volume 9, Issue 9. **doi: 10.1016/j.heliyon.2023.e19700**.

- **IEEE CONFERENCE PROCEEDINGS:**

2. "Effect of Quantum Repetition Code on Fidelity of Bell States in Bit Flip Channels." (**1st author**) **doi: 10.1109/ICECE57408.2022.10088665**.
3. "Effect of EOG Artifact Removal on EEG Motor-Imagery Classification." **doi: 10.1109/ICCIT57492.2022.10056062**.
4. "RESCUED: Robust Quantum Error Correction With Surface Code In Noisy Channels Using Ensemble Decoder." **doi: 10.1109/ICTP60248.2023.10490966**.

- **arXiv PREPRINTS:**

5. "Edge Detection Quantumized: A Novel Quantum Algorithm For Image Processing."(**arXiv:2404.06889**)(under review).
6. "Enhancing the security of image transmission in Quantum era: a chaos-assisted QKD approach using entanglement" (**arXiv:2311.18471**)(under review).
7. "Multi-Layered Security System: Integrating Quantum Key Distribution with Classical Cryptography to Enhance Steganographic Security" (**arXiv:2408.06964**)(under review).
8. "Enhanced Quantum Energy Teleportation using a 3-Qubit System" (**arXiv:2408.07997**)(On Progress).

TEACHING EXPERIENCE

Teaching Assistant — BRAC University, Dhaka **June 2023 - December 2024**

- Conducting **CSE 482 (Quantum Computing II)** tutorials and problem-solving classes.
- Conducting MAT120 lab sessions, teaching students how to solve calculus problems using Python.
- Teaching numerical methods and Python libraries, including NumPy, Matplotlib, SymPy, and SciPy.
- Creating assignments, administering tests for student assessment, and grading them.

Quantum Information Instructor — Tensor & MRA **January 2024 - November 2024**

- Instructor at the 3^{rd} PSI-Tensor Winter School for theoretical physics (Quantum Information Part).
- Conducting live sessions on Quantum Information (theory and simulations using QISKIT, Cirq, etc.) at MRA.

NOTABLE PROJECTS

- **Quantum Image Encoding and Decoding using Qiskit** — ***GitHub Link***.
  - Implemented quantum image encoding algorithm using FRQI and NEQR method.
  - Generalized both encoding circuit, also developed the decoding method.
  - Two Python libraries were used: *Qiskit* to simulate quantum cicuit, *Matplotlib* for image processing.
- **Load Flow Analysis for n Bus using Gauss-Siedel Algorithm** — ***GitHub Link***.
  - Developed a load flow analysis program for n-bus power systems during the junior year of undergraduate studies.
  - Implemented generalized Gauss-Siedel algorithm and generated output for user defined tolerance.
  - Coding was performed using MATLAB, and for file input/output management, CSV files were employed.
- **Bengali Speech Emotion Detection using Machine Learning** — ***GitHub Link***.
  - Conducted research on Bengali Speech Emotion Detection during the junior year of undergraduate studies.
  - Created a classification model for four emotions in Bengali speech: Sad, Happy, Angry, and Neutral.
  - Developed a training dataset and used MATLAB for the implementation.

SKILLS SUMMARY

Programming Language : Python, MATLAB, C, C++, Assembly language.
Simulation Software : PSpice, Proteus, Quartus, Simulink.
Office Application : Microsoft Office Suite, LaTeX.
Soft Skills : Organizing, Collaborating, Teaching, Writing.

HONORS AND AWARDS

- Presented at Q-Net Symposium by LSU APS Chapter (2025).
- Invited Speaker at SQuIC, BRACU on Quantum Communication (2024).
- Keynote Speaker at the event "Quantum Computing & Mechanics: Technical Prospects & Opportunities in Higher Studies" organized by IEEE NSU Student Branch (2022).
- 1st position in Mathematical Olympiad (University Level) of International Day of Mathematics organized by Bangladesh Mathematical Society (2021).
- University Admission Test Scholarship (2017) and Technical Scholarship (up to all semesters).
- General Scholarship, Cumilla Board, S.S.C 2014 and Talentpool Scholarship, Cumilla Board, J.S.C 2011.

SELECTED CERTIFICATIONS

- Completed "Tensor PSI Winter School for Theoretical Physics". (2023)
- Completed "Qiskit Global Quantum Summer School" organized by The Coding School. (2021)

EXTRA-CURRICULAR ACTIVITIES

- Assisted in the distribution of PPE during the COVID-19 emergency.
- Volunteered in the distribution of winter clothes in remote villages.
- Organized a nationwide online course on quantum mechanics and quantum computing.
- Engaged in numerous science outreach initiatives through writing blogs and articles.