



**Department of Electrical and Computer Engineering  
North South University**

**Senior Design Project**

**“Energy-Entanglement Relation For Minimal QET  
Model Using Superconducting Quantum Computers”**

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<b>Monem Shahriar Sourav</b>	<b>ID # 1831379042</b>

**Faculty Advisor:**

**Dr. Mahdy Rahman Chowdhury**

**Associate Professor**

**ECE Department**

**Summer 2023**



# LETTER OF TRANSMITTAL

Summer, 2023

To

Dr. Rajesh Palit  
Chairman,  
Department of Electrical and Computer Engineering  
North South University, Dhaka

**Subject: Submission of Capstone Project Report on  
“Energy-Entanglement Relation For Minimal QET Model”**

Dear Sir,

With due respect, we would like to submit our **Capstone Project Report** on the **“Energy-Entanglement Relation For Minimal QET Model using Superconducting Quantum Computers”** as a part of our BSc program. The report deals with the interrelation between the energy that is to be teleported using the minimal Quantum Energy Teleportation (QET) model and the changes in the entanglement of the quantum system of the model due to this. This project was valuable to us as it helped us gain experience from the theoretical field and apply it in real life, yielding practical results. We tried to the maximum competence to meet all the dimensions required by the report.

We will be highly obliged if you kindly receive this report and provide your valuable judgment. It would be our immense pleasure if you find this report useful and informative to have an apparent perspective on the issue.

Sincerely Yours,

.....  
Tasin Towsif Rahman  
ECE Department  
North South University, Bangladesh

.....  
Sibghat Ullah Rayyan Shaikh  
ECE Department  
North South University, Bangladesh

.....  
Monem Shahriar Sourav  
ECE Department  
North South University, Bangladesh

## APPROVAL

Tasin Towsif Rahman (ID # 1911774042), Sibghat Ullah Rayyan Shaikh (ID # 1831773042), and Monem Shahriar Sourav (ID # 1831379042) from the Electrical and Computer Engineering Department of North South University have worked on the Senior Design Project titled “**Energy-Entanglement Relation For Minimal QET Model using Superconducting Quantum Computers**” under the supervision of Dr. Mahdy Rahman Chowdhury in partial fulfillment of the requirement for the degree of Bachelors of Science in Engineering and has been accepted as satisfactory.

### Supervisor’s Signature

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**Dr. Mahdy Rahman Chowdhury**

**Associate Professor**

Department of Electrical and Computer Engineering

North South University

Dhaka, Bangladesh.

### Chairman’s Signature

.....

**Dr. Rajesh Palit**

**Professor**

Department of Electrical and Computer Engineering

North South University

Dhaka, Bangladesh.

# DECLARATION

This is to declare that this project is our original work. No part of this work has been submitted elsewhere, partially or fully for the award of any other degree or diploma. All project-related information will remain confidential and shall not be disclosed without the formal consent of the project supervisor. Relevant previous works presented in this report have been properly acknowledged and cited. The plagiarism policy, as stated by the supervisor, has been maintained.

Students' names and signatures

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**1. Tasin Towsif Rahman**

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**2. Sibghat Ullah Rayyan Shaikh**

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**3. Monem Shahriar Sourav**



## ACKNOWLEDGEMENTS

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Furthermore, we thank the Department of Electrical and Computer Engineering, North South University, Bangladesh, for facilitating the research. We would also like to thank **Syed Emad Uddin Shubha**, our research assistant, for helping us with this project. We would also like to thank our loved ones for their countless sacrifices and continual support.

# ABSTRACT

In the easiest terms possible, quantum entanglement means that two particles are together in such a way that the actions of one particle affect or cause changes to the other particle no matter the distance between the two particles. These particles could be photons, electrons, etc, and the state that they exist in could be, for example, one particle ‘spinning’ in one direction and the other spinning in the opposite direction. For our experiment, we consider two particles Alice and Bob. The goal of our study is to investigate the degree of breakdown of entanglement between the two for the minimal Quantum Energy Teleportation (QET) Model, during energy teleportation. Entropy is used as a quantitative measure of entanglement. The measurements in the circuit destroy the entanglement that exists between the two qubits when energy is transmitted from "Alice" to "Bob" in the Quantum Energy Teleportation (QET) Model. As a consequence, we use entropy to show the extent of degeneration in the entanglement; in other words, we present two disparities in the amount of transmitted energy and the entanglement expenditure. We investigate entanglement as a quantifiable physical resource in connection to energy in this experiment.