Senior Design Project Report

EEE 499

On chip material-based optical manipulation of Mie scatterers via quad-array metasurface

Submitted By

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Supervisor

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Associate Professor

ELECTRICAL AND COMPUTER ENGINEERING

NORTH SOUTH UNIVERSITY

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DECLARATION

This is to certify 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. Any material reproduced in this project has been properly acknowledged.

Students' name & Signature

1. Kazi Safkat Taa Seen

Safkat

2. Rakibul Hassan Shovon

Shovon

APPROVAL

The capstone project titled "**On chip material-based optical manipulation of Mie scatterers via quad-array metasurface**" by **Kazi Safkat Taa Seen (ID-1731191043)** and **Rakibul Hassan Shovon (ID-1620616642)** is approved for partial fulfillment of the requirement of the Bachelor of Science in Electrical and Electronics Engineering Degree on February and has been accepted as satisfactory.

Supervisor's Signature

MAHDY

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Dr. Mahdy Rahman Chowdhury
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Dhaka, Bangladesh.

Chairman's Signature

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Dr. Rezaul Bari
Associate Professor & Chairman

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ACKNOWLEDGEMENT

By mercy of Almighty Allah, we have completed our senior design capstone project titled “On chip material-based optical manipulation of Mie scatterers via quad-array metasurface”.

Foremost, we would like to express our sincerest gratitude to Dr. Mahdy Rahman Chowdhury, our sole supervisor for this project. Without his words of wisdom, belief in our abilities, motivation, enthusiasm, immense knowledge and continuous support throughout the whole of 499A and 499B, it would not have been possible to complete this project in such a commendable fashion.

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ABSTRACT

Deciphering the identity of nanoparticles and biomolecules from their existences in a myriad of applications within the scientific community becomes vastly essential at times. However, given their tremendously minuscule sizes and precise locations within a system or subsystem, the identification of the various types often becomes increasingly difficult. We, in this project, have devised a novel technique to distinguish classes of such objects based on their placement over a uniquely designed nanostructured interface. Using an illuminated double-lined metasurface, on chip material-based optical sorting of certain Mie-ranged silica (SiO_2), gold (Au) and chiral nanoparticles was performed based on the physical behaviors exhibited by them.

Keywords: Metasurface, Surface Plasmon Polaritons, Optical forces, Dielectrics, Plasmonics, Chirality, Plane-polarized Laser Beam, Particle Sorting