

# Irfan Nafiz Shahan

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## RESEARCH INTERESTS

Robotics, Computer Vision, Autonomous Vehicles

## EDUCATION

**Bachelor of Science (BSc) in Electrical and Electronic Engineering,** Jan 2019 - Present

Shahjalal University of Science and Technology (SUST), Sylhet, Bangladesh

**CGPA: 3.85 out of 4.00 (Rank: 1<sup>st</sup> out of class of 56)** 2x SUST STEM Scholarship (Merit) Recipient

**Over 10,000,000 BDT Grant for Top 10 Innovative Projects in Bangladesh – ICT Division Bangladesh**

**Dissertation Title: CARLASnowScenes: Towards Solving Adverse Weather – An analysis and approach to Synthetic Snow Road Scenes for Autonomous Driving** | *Developing a ground-up infrastructure for snow weather simulation and synthetic dataset in Unreal Engine 4 CARLA Simulator*

**Advisor:** Dr. Md. Rasedujjaman (PhD. Aix-Marseille Université and Institut Fresnel), Head, EE, SUST

**A-Level (Edexcel) Certificate**

July 2017-2019

Anandaniketan School and College, Sylhet, Bangladesh

**CGPA: 5.00 out of 5.00 (Higher School Certificate Equivalent)**

Further Pure Mathematics Track

**O-Level (Edexcel) Certificate**

July 2016-2017

Anandaniketan School and College, Sylhet, Bangladesh

**CGPA: 5.00 out of 5.00 (Secondary School Certificate Equivalent)**

Science Track | \**Achieved O-Level Country Highest in Fine Arts*

## RESEARCH EXPERIENCE

- **Undergraduate Dissertation, Shahjalal University of Science and Technology** Jan 2024 - Present  
*Supervisor:* Dr. Md. Rasedujjaman, Head of Dept. of Electrical and Electronic Engineering, SUST  
*Project Title:* CARLASnowScenes: Development of Synthetic Snow Weather Data for Autonomous Driving
- **Research Asst., Shahjalal University of Science and Technology** Mar 2023 – Dec 2023  
*Supervisor:* Dr. Md. Rasedujjaman, Head of Dept. of Electrical and Electronic Engineering, SUST  
*Project Title:* Development of Secure RFID Based Data Logging System for Large Institutions
- **Research Trainee, Shahjalal University of Science and Technology** Sep 2022 – July 2023  
*Supervisor:* Dr. Pabel Shahrear, Professor, Dept. of Mathematics, SUST  
*Training:* Implementation of Dynamical Systems in MATLAB  
*Project Title:* Expeditions on Time-Series Machine Learning Architectures for Dengue Outbreak Prediction (Data Provided by Institute of Epidemiology Disease Control And Research (IEDCR), Bangladesh)

## PUBLICATIONS

**Journals:** (In Preparation)

- **Shahan, et al.** "A Survey on Synthetic Approach to Autonomous Vehicles in Adverse Weather Conditions" *International Journal of Computer Vision*
- Md. Rasedujjaman, **Shahan et al.** "A Secure, Cost-Effective Approach to RFID Attendance Systems for Large Institutions" *IEEE Internet-of-Things Journal*
- **Shahan, et al** "TinyRecycler: A low-cost smart trash segregation system for developing countries utilizing Tiny ML"
- **Shahan, et al** "Towards better Braille Displays – An analysis and proposition for affordable braille displays"

**Conferences:** (In Preparation)

- **Shahan, et al.** "CARLASnowScenes: Towards Solving Adverse Weather Driving – An analysis and approach to Synthetic Snow Road Scenes for Autonomous Driving" *Computer Vision and Pattern Recognition 2025*
- **Shahan, et al.** "SUSTsat-1: A Low Cost Raspberry Pi based Multifunctional SmallSat capable of FSK, POCSAG, SSTV Telemetry"

**Poster Presentations:**

- Mowaz M. and **Shahan et al.** "I-Braille: An Affordable Internet-of-Things based Braille Display" in *Mujib 100 Idea Contest, International Conference on 4<sup>th</sup> Industrial Revolution 2021* | **Top 10 Most Innovative Ideas Award – 10,000 USD Grant** [[Poster](#)] [[Certification](#)] [[Video](#)]

**Preprints:**

- **Shahan, et al.** "A Real-Time DETR Approach to Bangladesh Road Object Detection for Autonomous Vehicles." Preprint on arXiv [[Ref](#)]
- **Shahan, et al.** "Towards Speaker Identification with Minimal Dataset using 1D-Convolution Neural Network" Preprint on arXiv [[Ref](#)]

## SCHOLARSHIPS, GRANTS AND FELLOWSHIPS (Received 10,000+ USD Student Grants)

1. SUST STEM "Professor Guaranga Deb Roy Memorial Scholarship" 2024 (Merit) | Awarded for Merit, potential and contribution to STEM
2. SUST STEM Scholarship 2023 Recipient (Merit) | Awarded to top 5 meritorious STEM students on campus. [[Ref](#)]
3. Grant Funding 10,000 USD | IC4IR 2021 | Top 10 Most Innovative Ideas [[Ref](#)]
4. IBM Quantum's Introduction to Quantum Computing 2022 | Full Scholarship - 8-month course awarded to 1000 applicants worldwide

## WORK EXPERIENCE

- **STEMX-365, MA, USA | Technical Assistant, Student Mentor** **May 2024 – Present**  
*JAXA (& NASA) org. Kibo-Astrobee ISS Robot Programming Challenge*  
**International Project Coordinator:** Mizanul H. Chowdhury (MIT Lincoln Lab, NASA Astrobee/SPHERES Scientist)  
STEMX-365 is a nonprofit organization committed to providing accessible, immersive, and interactive STEM education to every child, starting in Bangladesh. It is affiliated with NASA, JAXA and MIT through its founder. Mr. Mizanul H Chowdhury, Engineer at MIT Lincoln Laboratory, MIT ZeroRobotics Technical Expert and NASA Astrobee Scientist.  
**Key Responsibilities:**
- **Lead development and testing teams** - nested virtual machines for simulation deployment, ROS, Docker and Android Programming
  - **Make and develop robust Virtual Machines and online platform for ISS Astrobee Simulation** for training purposes
  - **Mentor prospective students** on NASA Astrobee and core astronomy and robotics concepts, autonomously operate Astrobee (a free flying robot) inside ISS, avoiding obstacles with 3D perception, and image processing.
  - **Conduct presentation sessions and webinars** to facilitate student learning
  - **Maintain wiki for stemx-365.org**
- **FrontierSatellites | Team Director** **Oct 2024 - Present**  
**Chief Advisor:** Mizanul Chowdhury (MIT Lincoln Lab, NASA Astrobee/SPHERES Scientist)
- **Stealth Student Satellite Engineering Group**
  - **Focused on making cost-friendly SmallSat Systems for space democratization**
  - **First principles engineering approach**
- **ULKASEMI, CA, USA | Industrial Trainee** **Nov 2024 – Present**
- **Analog and IC Layout Design and Post Layout Verification**
  - **Physical Design (PnR), IC development lifecycle, CTS, and design sign-off using EDA tools.**
  - **Industry Practices:** IC design workflows, layout challenges, power integrity analysis tailored to real-world.
- **TICI, Bangladesh | Industrial Trainee** **Dec 2024 – Jan 2024**
- **PLC Design and Verification**
  - **Industrial PLC Practices**

## LEADERSHIP EXPERIENCES

- **Columbia University NEBDHub NSDC SUST Chapter | Founder, President** **Jul 2023 – Present**  
The community of National Student Data Corps (NSDC) is operated by Northeast Big Data Innovation Hub (NEBDHub), affiliated with Columbia University, which drives innovation in big data. It connects academia, industry, all over the world advancing research and education in data science.  
**Key Achievements:**
- **Pioneered the first, 2-month long event data-literacy event DATADRIVE 1.0 A Speedrun to Advanced Machine Learning**
  - **Collaborated with international companies eg. HerWILL, to provide workshops on Natural Language Processing and Semantic Analysis**
- **RoboSUST | Director of Robotics** **Jul 2021 – Present**  
**Previously Held Positions:**  
*Research and Development Secretary (1 Year)*  
*Asst. Research and Development Secretary (2 years),*  
RoboSUST is the only robotics-based student organization in my university. As Director of Robotics, I spearhead the organization's technical and competitive success, fostering innovation and excellence in robotics.  
**Key Achievements:**
- **Mentee Team Global Nominee in NASA Space Apps Challenge 2024**
  - **Introduction to Python Workshop**
  - **SUSTsat-1** – Initiated the SUSTsat Megaproject
  - **JAXA KRPC 2023 2<sup>nd</sup> Runner Up**
- **NMOSS | Co-Founder, CTF Lead** **Jan 2022 – Jan 2024**  
NMOSS, was a SUST-based Independent Computer Security Research and Competitive Group. As CTF Lead, I lead our teams in International and National CTF Competitions.  
**Key Achievements:** [\[Link\]](#)
- **Conducted first CyberSecurity Competition and Workshop in SUST**
  - **Ranked 14<sup>th</sup> in 2022 throughout Bangladesh in ctfme.org** within 8 months of the establishment of NMOSS. [\[ctfme\]](#)
  - **Top 3% of all teams internationally on Hack the Box: CyberApocalypse 2023 | 2<sup>nd</sup> Position in Bangladesh Region**

## INVITED TALKS

1. NSDC Bi-Annual Meeting May 2024
2. NSDC Bi-Annual Meeting Nov 2023
3. "Meet Team I-Braille – An Experience Sharing Session" by STUDIO XI, Dept. of Architecture, SUST

## PROFESSIONAL SERVICES

- **Technical Assistant** in International Science, Technology, Engineering, Mathematics and Education Conference 2023, Huston-Tillotson University, TX, USA [\[Ref\]](#)

## STUDENT SUPERVISION

- **CERN, A Beamline for Schools (BL4S)**, Team Invicta Coach, “**Effect on Quantum Particles on Microcomputers**” | First Bangladeshi Shortlisted Team [\[Ref\]](#)[\[Cert\]](#)
- **JAXA Asian Try Zero Gravity Challenge 2023**, Mentor, “**Finding the Shape of Magnetic Field Lines**” | Winner Category A, First Bangladeshi Experiment performed in Kibo Module, ISS [\[Ref\]](#)
- **JAXA Kibo ABC-Award 2023**, (Co-Supervisor with Mizanul Chowdhury, Saba J. Chowdhury) | (Category A) 1<sup>st</sup> Place [\[Ref\]](#)

## HIGHLIGHT PROJECTS [<sup>+</sup>Linked]

### Robotics, IoT and ML Projects:

<sup>+</sup>[KiboxIcarus](#) | A ROS based simulation of NASA's Astrobee for unmanned space robot used for repairs during an ammonia leak on the ISS

- **2<sup>nd</sup> Runner Up Project in JAXA Kibo RPC National Round**, a JAXA based international space robotics competition which included 3 rigorous methods of testing and judgement undertaken by industry and academic experts in JAXA
- **Utilized a Ray Tracing (RT) algorithm paired with Floyd Warshall** to minimize time of travel within KIZ KOZ zones
- **OpenCV preprocessing enhances localization of defects**

<sup>+</sup>[iBraille](#) | An Prototype Affordable Braille Display for the Visually Impaired

- **Project received 10,000 USD in seed funding** from ICT Division Bangladesh which was a process that included 5 rigorous methods of testing and judgement undertaken by industry and academic experts
- **Champion Project in Mujib 100 Idea Contest 2021**, that took place in IC4IR Conference 2021 out of 1000+ academic and industry teams nationwide
- **Utilized financial analysis, and logistic analysis to reduce average product cost by 400%** of an average braille display
- **Rigorous 4-stage selection process** – final proposal to 14+ industry and academic experts via an online pitch among 50 finalists

<sup>+</sup>[SUSTsat-1](#) | A Low Cost Raspberry Pi based Multifunctional SmallSat capable of FSK, POCSAG, SSTV Telemetry

- **Utilizes LoRa based Chirp Spread Spectrum technology for communication with Ground System (GS)** for FM based communication over Low Earth Orbit (LEO)
- **SDR based ground station**, utilizes an RTL-SDR to decode LoRa Chirps.

<sup>+</sup>[TinyRecycler](#) | A TinyML based, cost-friendly Smart Trash Segregator, with its own custom 2D-ConvNet, integrated with Edge Impulse API.

Course Project: Microprocessor and Interfacing Lab – EEE-334

- **Utilizes Edge Impulse API and Framework to maximize model performance with Validation and Test Accuracies of 86% and 84%**
- **Built a custom dataset of 250+ images containing 5 recyclable classes**, preprocessed and curated for the computer vision classification
- **Reduced SRAM (85kB), for deployment on an edge embedded device**, namely Arduino Nano BLE Sense 33 and TinyML Shield.

<sup>+</sup>[RecMe](#) | A Signal Processing and Machine Learning Model Optimized for Speaker Identification with Minimal Dataset in Embedded ML Systems.

Course Project: Digital Signal Processing I Lab– EEE-332

Supervisor: Dr. Md. Rasedujjaman, Head of Department, EE, SUST

- **Custom Minimal dataset model of 1d-ConvNet** to enable deployment on edge embedded devices with low power consumption.
- **Designed a user-friendly PyQt5 UI with an intuitive Console embedded within the UI**, that enables the creation of new dataset and manage the application completely from scratch.
- **Created preprocessing algorithm** using DSP techniques to make a seamless dataset creation experience within the GUI
- **Conducted Model Architecture Optimization** to ensure speech features are captured and classification accuracy is highly accurate even on minimal dataset.
- **Performed hyperparameter tuning** using Tensorboard to conduct evaluation.

**MachineAlert** | An Embedded Machine Learning based machine anomaly detector, for detection of abnormal activity and necessary repairs

- **Utilizes K-Means Nearest Neighbors** to detect abnormal machine activity using Anomaly Detection for early repairs before breakdown

### VR Projects:

<sup>+</sup>[Project Icarus](#) | A VR/AR Based Space Simulator VideoGame made with Unity Engine

- **Led a team of 6**, constituting 3 collaborating national universities in Bangladesh – IUT, SUST and DU
- **Competed against 220,000+ registrants globally**, and secured global top 420 position as ‘**Global Nominee**’ on **NASA Space Apps Challenge 2022**
- **Elected as Regional Champion of NASA Space App Challenge 2022**, among 100+ teams nationwide
- **Uses a robust N-Body Simulation Algorithm** to create an Immersive Space Experience
- **NASA Open Source Data were used** to create a lasting experience of real-time events and objects

<sup>+</sup>[Perseverance Re-imagined](#) | A VR Based Recreation Perseverance Rover Launch, Landing and Deployment in Mars Terrain developed on Unity Engine.

- **Led a team of 6**, constituting 3 collaborating national universities in Bangladesh - RUET, SUST and DU
- **Competed against 1,000+ registrants nationally**, and secured global top 50 position
- **3D mapping, 3D audio and localization** to create immersion.
- **WebGL deployment allows webVR** for easy plug and play on our custom web server.
- **Utilized NASA Open Source Data**

### Electrical Design Projects:

**Buck-Boost Converter** | A N-Channel MOSFET based 4V to 0.5-12V conversion for PVT Systems

Course Project: Power Electronics Lab – EEE-340

- **Conducted design and contingency analysis using simulation and testing** using LTSpice.
- **Created a custom ATmega328P based gate driver**, that uses overwritten timer registers on the microcontroller to perform Fast PWM

**12V Dual DC Power Supply** | E-I Shell Core Transformer that Supplies 12V Dual Power Supply

Course Project: Electrical Machines 1 Lab – EEE-224

- **Utilized a filtering stage and buck module to deduce ripple factor significantly** and bring output voltages to required level
- **Simulated tests via LTSpice and KiCAD software**

## CERTIFICATIONS

1. **STANFORD University and DEEPLARNING.AI** | Neural Networks and Deep Learning [\[Ref\]](#)
2. **EDGE IMPULSE ADVOCATE** | Introduction to Embedded Machine Learning [\[Ref\]](#)
3. **MICROSOFT Student Learn Ambassador** | Object Detection with Azure Custom Vision [\[Ref\]](#)
4. **IBM QUANTUM COMPUTING CERTIFICATION** | Introduction to Quantum Computing [\[Ref\]](#)
5. **AUTODESK FUSION 360 CERTIFICATION** | Introduction to Autodesk Fusion 360 [\[Ref\]](#)

## AWARDS AND HONORS

### International:

- **2<sup>nd</sup> Runner Up** | Kibo Robot Programming Challenge 2023 organized by JAXA and NASA [\[Ref\]](#)
- **Global Top 3% [Rank 179th], 2<sup>nd</sup> in Bangladesh Region** | CyberApocalypse 2023 CTF organized by Hack the Box [\[Ref\]](#)
- **Regional Champion, Global Nominee** | NASA Space Apps Challenge 2022 organized by NASA and BASIS, BD [\[Ref\]](#)
- **Gold Medalist, Top 2% Worldwide** | International Astronomy and Astrophysics Competition 2021 (IAAC) organized by Edu.Harbour, Germany [\[Ref\]](#)

### National:

- **6<sup>th</sup> in DL Enigma 2024** | A Nation-wide Computer Vision Competition based on Autonomous Vehicle, Road Vehicle Detection. [\[Ref\]](#)
- **Runner Up** | RoboSUST Senior Project Hunt 2022
- **Finalist** | **BIKIRON Sustainable Energy Innovation Challenge 2021**
- **Bangladesh Physics Olympiad 2019** | Category C | 16<sup>th</sup>
- **Bangladesh Physics Olympiad 2018** | Category B | 2<sup>nd</sup> Runner Up

## MEMBERSHIPS

IEEE – Student Member  
SUST IEEE Student Branch – Vice Chair (Research & Development)

## SKILLS

<b>Lang:</b> Python, C, C++, C#, MATLAB, Verilog, Bash, Java	<b>Hardware:</b> RPLidar, Arduino & Raspberry Pi Boards, Nvidia AMD
<b>Robotics:</b> Raspberry Pi OS, Arduino, ROS, Edge Impulse, Astrobee from NASA	GTX and RTX Boards, Oculus Rift S VR Headset, Samsung Odessey VR Headset,
<b>Technology:</b> Deep Learning, Computer Vision, ASR, Image Proc., Object	3D Printing, RTL-SDR
Detection and Localization, SLAM, VR and AR, GameDev, WebDev	<b>Electrical Simulation:</b> KiCAD, LTSpice, TinkerCAD, Virtuoso, EasyEDA
<b>Frameworks:</b> Tensorflow, PyTorch, OpenCV, Edge Impulse	<b>Misc:</b> Git, Github, Gitlab, Blender, Fusion360, Dock

## COMMUNITY SERVICE

- |   |  |
|---|--|
| 1. <b>Member</b> , Anandaniketan Earth Club       | <b>Aug 2016 - May 2019 · 2 yr 10 mos</b> |
| 2. <b>Member</b> , Anandaniketan Aqua House       | <b>Aug 2016 - May 2019 · 2 yr 10 mos</b> |
| 3. <b>Radio Musician</b> , Bokultola Music School | <b>Jun 2017 – Aug 2017 · 2 mos</b>       |
| 4. <b>Volunteer</b>   Kid's Campus Pre-school     |  |

## ACTIVITIES

Idea Contests. Case Contests, Line Follower Robot Competitions, Capture the Flag (Jeopardy) Cybersecurity Contests, Badminton

## PERSONAL INTERESTS

Badminton, Bodybuilding, Hacking, Guitar, Fine-Arts

## REFERENCES

- |   |  |
|---|--|
| 1. <b>Mr. Mizanul Haq Choudhury, MIT Space Systems Lab, NASA Astrobee/SPHERES Scientist</b><br>STEMX-365 Project Coordinator, FrontierSatellites Chief Advisor<br>Massachusetts, USA<br>Contact: <a href="mailto:mizanul@mit.edu">mizanul@mit.edu</a>             | 3. <b>Dr. Farzana Hussain, Professor and Chair, Dept of Mathematics, HTU</b><br>Research Supervisor, SUST STEM Scholarship Coordinator<br>Austin, TX, USA<br>Contact: <a href="mailto:fhussain@htu.edu">fhussain@htu.edu</a> |
| 2. <b>Dr. Md. Rasedujjaman, Professor and Head of Dept of EEE, SUST</b><br>BSc. Dissertation Supervisor, Research Supervisor<br>PhD. Aix-Marseille Université and Institut Fresnel<br>Sylhet, BD<br>Contact: <a href="mailto:mrased@sust.edu">mrased@sust.edu</a> | 4. <b>Dr. Pabel Shahrear, Professor, Dept. of Mathematics, SUST</b><br>Research Trainer and Supervisor,<br>Sylhet, BD<br>Contact: <a href="mailto:pabelshahrear@yahoo.com">pabelshahrear@yahoo.com</a>                       |