Eftakhar Ahmed Arnob

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RESEARCH STATEMENT

Graduate Researcher at the intersection of **Computer Vision, Robotics, and CPS Security**. My research secures critical physical systems against physical-layer threats by integrating **physics-based constraints** into sensory perception pipelines. While my last work exposed zero-day vulnerabilities in commercial smart cameras (Google Nest, Ring) and produced **provisional-patented** defenses with >98% accuracy, my broader focus spans **visual sensors security** in autonomous vehicles and control systems for **bio-inspired robotics**. Dedicated to **research independence**, I prioritize open-source artifacts and decline of monetary bounties to ensure unrestricted academic dissemination.

EDUCATION

Auburn University
Auburn, AL, USA ***Ph.D.*** *in Computer Science and Software Engineering* | **Aug 2024 – Present**
Advisor: Dr. Yazhou Tu

North East University Bangladesh
Sylhet, Bangladesh ***B.Sc. (Engg.)*** *in* Computer Science *and Engineering* | **Jan 2019 – June 2023**

PATENTS & PUBLICATIONS

Patents

- **Arnob, E. A., Tu, Y., Hei, X.,** et al. *"Detecting Optical Injection Attacks on Cameras by Harnessing Adversarial Optical Physics"*
    - **Status**: Provisional Patent (Jan 2026) [**Application ID: 2026-025**].
    - **Description**: A physics-based, non-AI approach to detecting laser and rolling-shutter light injection attacks on vision sensors.
- **Arnob, E. A., Tu, Y., Hei, X.,** et al. *"Lens Shield – Out of View Laser/Optical Injection* ***Shield (ID: 2026-070)"***

Selected Publications

- **Arnob, E. A., Tu, Y.,** et al. *"Seeing Isn't Securing: Mitigating Vision Perception Threats in Smart Home Security Systems by Harnessing Adversarial Optical Physics."*
  Status: To be submitted to **NDSS 2027 [A]***
- Ovee, T. A., **Arnob, E. A.,** Louf, J. F**.** *"Plant-Inspired Elastic–Hydraulic Tactile Sensing Enables Quantitative Stiffness Estimation in Soft Robots."*
  Status: **Accepted** to **Soft Robotics** (May 2026). | DOI: 10.1177/21695172261453210.
- Ovee, T. A., **Arnob, E. A.,** Louf, J. F**.** *"Efficiency-Driven Neural Network for Real-Time Shape Completion"*

Status: Submitted to **Springer Nature** (2026 – Under Review).

- Ovee, T. A., **Arnob, E**. (Co-First Author) A., Louf, J. F**.** *"ED2 dataset."*
  DOI: 10.21227/k52q-qs41 (2025).

MEDIA COVERAGE

- **"Assistant Professor in CSSE Exposes Vulnerability in AI-Powered Security Cameras."**
  Auburn University News, October 2025.
  Source: Auburn News Link

RESEARCH EXPERIENCE

Graduate Research Assistant | Cyber-Physical Security Lab *Auburn University (CSSE Dept) | Advisor: Dr. Yazhou Tu* | **Aug 2024 – Present**

- **Optical Injection Defense (Provisional Patent filed with Auburn IPX office):** Exposed zero-day physical-layer vulnerabilities in 9 commercial smart security cameras (including Google Nest, Amazon Ring, Arlo) via **light injection attacks**.
  - **Physics-Based Mitigation:** Pioneered the first systematic optical physics defense, inventing two training-free algorithms (Spectral-Spatial & Environmental Mapping) that detect attacks without deep learning.
  - **Impact:** Achieved detection rates of **98.44%** and **99.22%** across 970 real-world and simulated scenarios.
  - **Responsible Disclosure:** Managed disclosures with Google, Amazon (Ring), and Arlo. Secured vulnerability acceptances and **declined monetary bug bounties** to maintain research independence.

- **Broader CPS Security Research:** Investigated adversarial threats across autonomous vehicles, GPS receivers, and BCI prosthetics, engineering systems like SLAM/IMU sensor fusion framework to detect signal injection and cyber-physical interruptions.

- **Autonomous Vehicle Vision Security Framework (Ongoing):** Developing an adversarial testing framework to evaluate the security and performance of self-driving autonomous systems under physical-layer vision injection attacks targeting onboard camera and vision modules.
  - **Adversarial Attack & Evaluation:** Designing attack simulation pipelines to expose failure modes in perception stacks (object detection, lane recognition, depth estimation) under optical adversarial conditions.
  - **Defense & Mitigation:** Architecting the framework for extensibility to support future integration of detection and mitigation modules tailored for autonomous vehicle deployment constraints.

Research Affiliate | NiFELab, Auburn University (Chemical Engineering Dept) *Supervisor: Dr. Jean-François Louf* | **2022 – Aug 2024**

- **Soft Robotics Control:** Engineered electronic control systems for "Plant-Inspired Poroelastic Soft Robots," enabling precise mechano-sensing experiments.

Undergraduate Researcher | North East University Bangladesh Advisor: Noushad Sojib | **2022 – 2023**

- **Machine Learning**: Developed an efficient Encoder-Decoder model for "2D Partial Natural Shape Recognition," focusing on missing trajectory prediction.

ACADEMIC SERVICE & LEADERSHIP

Technical Trainer & Mentor | North East University Bangladesh

- **Robotics Lab**: Led embedded systems workshops (Arduino/ESP8266), guiding peers from circuit theory to functional hardware prototyping.
- **ACM Programming Workshop**: Mentored junior students in algorithmic problem-solving for national competitive programming contests.

Teaching Assistant | North East University Bangladesh

ACADEMIC CONFERENCE PRESENTATIONS

- Presented Talk at **AIChE Annual Meeting 2022** - Poroelastic Mechano-Sensing Soft Robots
  Phoenix Convention Center, N-122A, USA - November 17, 2022
- Presented Talk at **AIChE Annual Meeting 2023** - Plant-Inspired Mechano-Sensing Soft Robots
  Hyatt Regency Orlando, USA - November 9, 2023
- Presented Talk at **CompFlu 2023** - Plant-Inspired Mechanosensitive Soft Robots
  Chennai, India - 18th to 20th December, 2023
- Accepted Talk at **APS DSOFT 2024** - Poroelastic Mechanosensing Soft Robots

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PROFESSIONAL EXPERIENCE

- **Software Engineer** | Dorik Inc. | (**2023** - **2024**).

SKILLS

- **Research & Core Competencies:** Cyber-Physical Systems (CPS) Security, Computer Vision, Robotics Control, SLAM.
- **Languages:** Python, C, C++, Java, Kotlin, MATLAB, JavaScript.
- **Hardware & Embedded Systems:** Arduino, ESP32/ESP8266, Optical & Laser Testbeds, Sensor Fusion, Microcontroller Programming.
- **Libraries & Tools:** PyTorch, OpenCV, Android Studio, LaTeX, Git.

ACHIEVEMENTS & AWARDS

1. **National Rank 90th, 103rd, 141st:** ICPC Dhaka Regional Onsite Contests **(2020, 2021, 2022)**
2. **World Rank 1677th (National 13th):** Google CodeJam 2021 Qualification Round. Username: arnabxero **(2022)**
3. **1st Position:** in District Level on a National Talent Hunt Competition **(2014)**
4. **2nd Runner Up:** SJ Innovation Hackathon 2021 | Team: Gladiators **(2021)**
5. **Champion:** NEUB Eid Mubarak Programming Contest | Username: arnabxero **(2019)**