FANGZHENG LIU

fzliu@mit.edu ◇ Fangzheng's github ◇ Portfolio

EDUCATION

Massachusetts Institute of Technology September 2021 — Present
Ph.D. in Media Arts and Sciences *Responsive Environments Group, MIT Media Lab*

Massachusetts Institute of Technology September 2019 — Aug 2021
M.S. in Media Arts and Sciences *Responsive Environments Group, MIT Media Lab*

Beijing Institute of Technology September 2015 — Apr 2018
M.S. in Information and Communication Engineering

Beijing Institute of Technology September 2011 — Jun 2015
B.S. in Information Engineering

WORK EXPERIENCE

Engineer Apr 2018 — Apr 2019

CERN (the European Organization for Nuclear Research)

· Designed a control and monitoring software for the thermal vacuum test of the UTTPS (Upgraded Tracker Thermal Pump System). The UTTPS is an upgraded thermal system for the AMS-02 (Alpha Magnetic Spectrometer, a high-energy particle Spectrometer operating on the International Space Station).
· The UTTPS has been installed to the AMS-02 by the end of Jan 2020 through four spacewalks.

ACADEMIC RESEARCH EXPERIENCE

AstroAnt - to the moon! Jan 2021 — Mar 2023
MIT Media Lab

· Lead engineer of the MIT Media Lab AstroAnt Lunar mission.
· Designed a miniature robot that will be sent to the Lunar South Pole in 2024. The robot will be working on the top panel of a Lunar rover MAPP-1 (developed by the Lunar Outpost) to collect thermal data.
· Finished four parabolic flights, a total of 120 parabolas.
· Finished all space-grade tests for the AstroAnt, and achieved the TRL 8 level.
· The AstroAnt will be sent to the Lunar South Pole in the IM-2 mission (Intuitive Machines-2) in 2025.

LunarWSN Nov 2020 — Aug 2021
MIT Media Lab

· Designed a miniature cubic wireless sensor node, that we named "LunarWSN", that can be ballistically deployed from rovers/landers or dropped from a fly-by satellite to the Lunar surface.
· The LunarWSN node is designed for In-Situ lunar water ice detection.
· Finished all the system function tests in a lab environment and achieved the TRL 4 level.

HexSense May 2023 — Present
MIT Media Lab

- Designed a miniature hexagon-pillar-shape wireless sensor node, that we named "HexSense", that can be ballistically deployed from rovers/landers or dropped from a fly-by satellite to the Lunar surface.
- After deployment, the HexSense can automatically self-oriente itself and start working.
- Finished all the system function tests in a lab environment and achieved the TRL 4 level.
- Finished a 10-day field experiment in Svalbard in July 2023.
- Finished a 7-day field experiment in the lava tubes on the Canary Island in Feb 2024.
- Finished one parabolic flight (30 parabolas) in May 2024 and proved self-orientation capability in Lunar gravity.

LunarDeltaT Feb 2023 — Jun 2023
MIT Media Lab

- Designed a new approach to harvest energy through temperature gradient across the surface of wireless sensor nodes working on the Lunar surface.
- Finished all tests in a lab environment. LunarDeltaT shows an advantage over solar cells in a dusty environment.

PCBPT Aug 2019 — Oct 2019
MIT Media Lab

- Designed a bench-top tool to streamline the in-circuit debugging.
- With the help of the PCBPT, when debugging PCB, all users need to do is select signals and check the output without the need to do anything else.

CircuitScout Jun 2023 — Oct 2023
MIT Media Lab

- An upgraded version of the PCBPT with a web-based GUI.

IO-Touch Oct 2023 — Nov 2023
MIT Media Lab

- Designed a pure software approach that can turn almost every GPIO into a capacitive sensor.

Mind Cube Jul 2024 — Aug 2024
MIT Media Lab

- Designed a mini fidget cube toy that can collect data from all the sensors when it is played in a hand. The data collected can be used to study one's real-time emotion. The Mind Cube can also be used as a music/game controller.

PUBLICATIONS

- **Fangzheng Liu**, Nathan Perry, Ariel Ekblaw, and Joseph A Paradiso, 2025. "A Field Expedition and Parabolic Flight Experiment for the HexSense: A Type of Ballistic Deployed Self-Oriented Wireless Sensor Nodes for Future Lunar Exploration". In AIAA Scitech 2025 Forum.

- **Liu, F.**, Haddad, D.D. and Paradiso, J., 2024, October. MindCube: an Interactive Device for Gauging Emotions. In Adjunct Proceedings of the 37th Annual ACM Symposium on User Interface Software and Technology (pp. 1-2).

- **Fangzheng Liu**, Cody Paige, Ariel Ekblaw, and Joseph A Paradiso. "HexSense: Self-Oriented Ballistic Deployed Wireless Sensor Nodes for Lunar Exploration". In Accelerating Space Commerce, Exploration, and New Discovery (ASCEND) 2024.

- **Fangzheng Liu**, Kerri Cahoy, Ariel Ekblaw, and Joseph A Paradiso. "A Wireless Lunar Sensor Node Powered by Temperature Gradients across the Device's Surface". In The 45th International IEEE Aerospace Conference (2024).

- **Liu, F**. and Paradiso, J.A., 2023, October. PrintedCircuit Board (PCB) Probe Tester (PCBPT)-a Compact Desktop Systemthat Helps with Automatic PCBDebugging. In Adjunct Proceedings of the 36th Annual ACM Symposium on User Interface Software and Technology (pp. 1-3).

- **Fangzheng Liu**, Ariel Ekblaw, Joseph Paradiso. "LunarWSN node - a Wireless Sensor Network node designed for In-Situ lunar water ice detection." SmallSat conference 2022 (Aug 2022).

- Ariel Ekblaw, Juliana Cherston, **Fangzheng Liu**, Irmandy Wicaksono, Don Derek Haddad, Valentina Sumini, Joseph A. Paradiso. "From UbiComp to Universe - Moving Pervasive Computing Research Into Space Applications." IEEE Pervasive Computing 2022.

- B Haghighat, J Boghaert, Z Minsky-Primus, J Ebert, **F Liu**, M Nisser, A Ekblaw, and R Nagpal. "An Approach Based on Particle Swarm Optimization for Inspection of Spacecraft Hulls by a Swarm of Miniaturized Robots." In 13th International Conference on Swarm Intelligence (ANTS 2022).

- LUO Qing-sheng, ZHOU Chen-yang, JIA Yan, GAO Jian-feng, **LIU Fang-zheng**: "CPG-Based Control Scheme for Quadruped Robot to Withstand the Lateral Impact." 2015. Journal of Beijing Institute of Technology, 35(4), pp.384-390.

PATENTS

- CUI Wei, HOU Jian-gang, **LIU Fang-zheng**, SHEN Qing, XIANG Jing-zhi, WU Si-liang: "A Radar Echo Delay Coherent Simulation Method Based on Digital Radio Frequency Signal Storage." Chinese patent: 2017104551967 (G01S7/40). Filed on Jun 16, 2017, and issued on Dec 18, 2018. [LINK] (Advisors: CUI Wei, HOU Jian-gang)

- CUI Wei, SHEN Qing, HOU Jian-gang, **LIU Fang-zheng**, XIANG Jing-zhi, WU Si-liang: "A Doppler Frequency Coherent Simulation Method for Radar Echoes Based on Real-time Frequency Measurement." Chinese patent: 2017104552014 (G01S7/40). Filed on Jun 16, 2017, and issued on Oct 9, 2018. [LINK] (Advisors: CUI Wei, HOU Jian-gang)

TECHNICAL SKILLS

- **Electronics** - Embedded system (nRF52, STM32, ATSAMD, ESP32), FPGA (Xlinix 7 series), analog circuit

- **Programming languages and related** - C, C++, VHDL, Python, Git, LabVIEW, Arduino

- **Computer-aided design/engineering** - Altium Designer, KiCAD, EasyEDA, Mentor Graphics PADS, SolidWorks, Fusion 360, Inventor, Onshape.

- **Manufacturing skills** - 3D modeling/printing, Molding & Casting, CNC machining, PCB milling, PCB soldering, Laser cutting, water jet cutting.

- **Space grade tests** - thermal vacuum test.

- **Others** - Parabolic flight certificates !!! :)

TEACHINGS AND ACTIVITIES

- **Teaching Assistant** (2024 Fall) - MIT course "MAS.863/4.140/6.9020 How To Make (almost) Anything"

- **Teaching Assistant** (2023 Fall) - MIT course "MAS.863/4.140/6.9020 How To Make (almost) Anything"
- **Head Teaching Assistant** (2022 Spring) - MIT course "MAS.836 Sensing Technologies for Interact Environments"
- **Teaching Assistant** (2021 Spring) - MIT course "MAS.S76 Adventures in Sensing"

AWARDS

- **The Create the Future Design Contest category winner (Robotics and Automation)** (2024-2025 academic year)
- **Harold Horowitz (1951) Student Research Fund award** (2023-2024 academic year)
- **Angela Leong Fund Fellowship** (2022-2023 academic year) - 1 student/year in MIT
- **Intel Cup Undergraduate Electronic Design Contest - Embedded System Design Invitation Contest** (2014) - Second prize
- **China National Scholarship** (2011) - Top 0.2%

INTERESTS

Hiking Cycling rock climbing Basketball Electronics