Unmanned Aerial Systems Research

Unmanned Aerial Systems Research

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In 2012 Nevada began a robust effort to secure the FAA designation as one of six UAS test sites. On December 30, 2013 Nevada was designated as an official test site. This has spawned a renaissance in the UAS industry as manufacturers extend their vision beyond the military market to national and international commercial applications including a wide variety of new platforms and sensor technologies.

UAS systems have entered the civilian market due to increased industry needs. This expanded use has in turn increased the demand for research in UAS manufacturing; sensor developers and operators; and applied research and development capabilities.

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Why UNLV?

The State of Nevada and Clark County already has in place several assets necessary for developing and sustaining the growth demanded by the UAS industry. These assets include:

- A wide and expansive restricted airspace system in which large-scale experiments and testing can be conducted
- A large number of experienced personnel expanding their application of UAS for national defense systems
- A strong and relevant curriculum offered by UNLV
- A well-developed educational outreach program necessary for work force enhancement

Faculty Involved in Unmanned Aerial Systems Research

Dr. Yi-Tung Chen
Professor and ASME Fellow, Department of Mechanical Engineering
Co-Director, Center for Energy Research

Dr. William Culbreth
Associate Professor, Department of Mechanical Engineering

Dr. Sarah Harris
Associate Professor, Department of Electrical and Computer Engineering

Dr. Ju-Yeon Jo
Associate Professor, Department of Computer Science

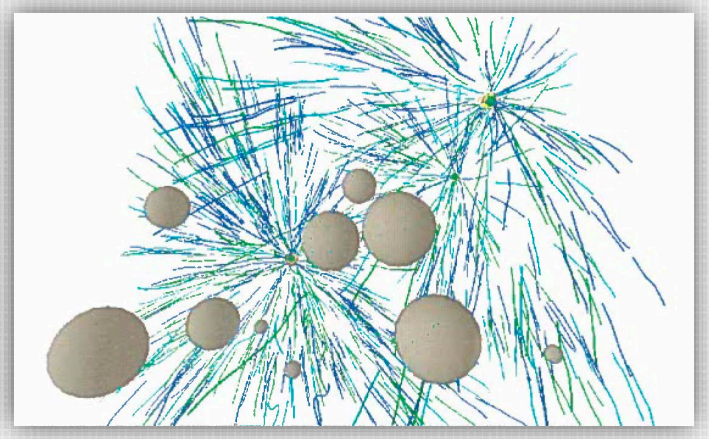
Dr. Si Jung "SJ" Kim
Assistant Professor of Entertainment Engineering and Design

Dr. Yoohwan Kim
Associate Professor, Department of Computer Science

Dr. Shahram Latifi
Professor, Department of Electrical and Computer Engineering
Director, Center for Information and Communications

Dr. Brendan Morris
Associate Professor, Department of Electrical and Computer Engineering

Dr. Venkatesan Muthukumar
Associate Professor, Department of Electrical and Computer Engineering



With refreshing disabled, the agent paths are more evident. *C. Wolverton*

Faculty Involved in Unmanned Aerial Systems Research

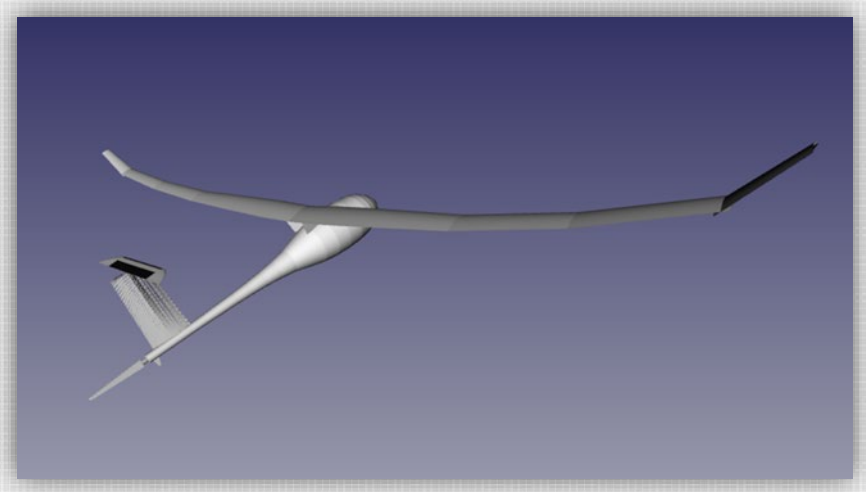
Dr. Paul Oh
Lincy Professor of Unmanned Aerial Systems, Professor and ASME Fellow, Department of Mechanical Engineering
Director, Drones and Autonomous Systems Lab

Dr. Emma Regentova
Professor, Department of Electrical and Computer Engineering

Dr. Ebrahim Saberinia
Associate Professor, Department of Electrical and Computer Engineering

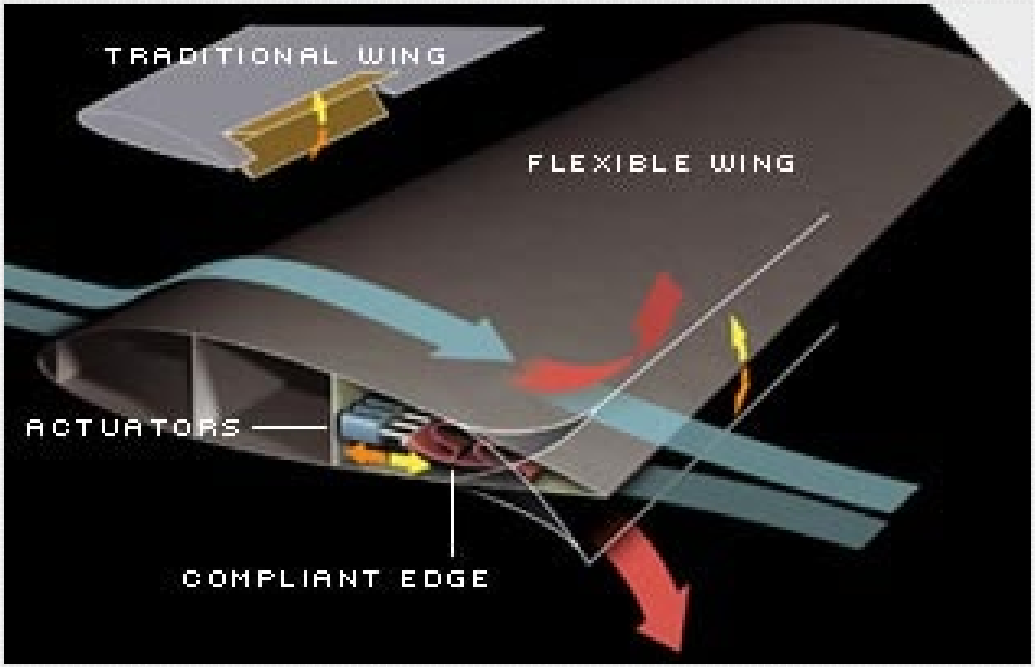
Dr. Evangelos Yfantis
Professor, Department of Computer Science

Dr. Woosoon Yim
Professor and ASME Fellow, Department of Mechanical Engineering



Unmanned Aerial Systems

Research Highlights



Unmanned Aerial Systems Research

Dr. Yi-Tung Chen

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Co-Director, Center for Energy Research

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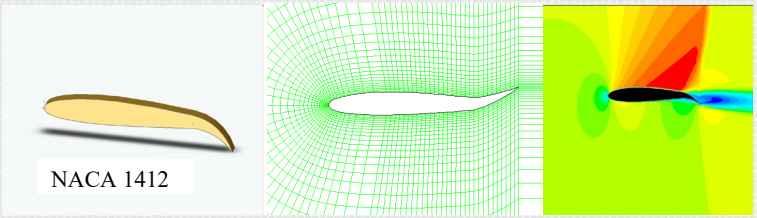
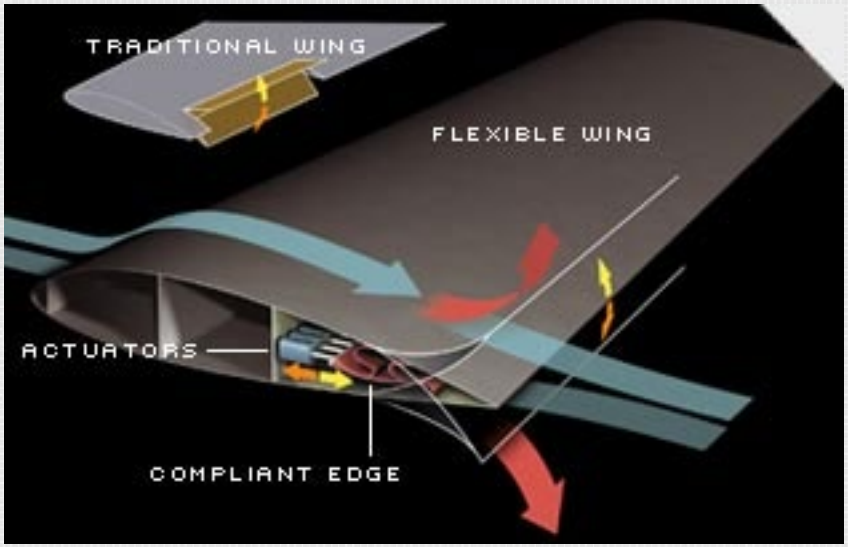


- Research Interests
  - Computational fluid dynamics
  - Fluid-structure interaction
  - Smart wing design
  - Aircraft maneuver
  - Aerodynamics
  - Biomimic simulation



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Dr. William Culbreth
Associate Professor, Department of Mechanical Engineering

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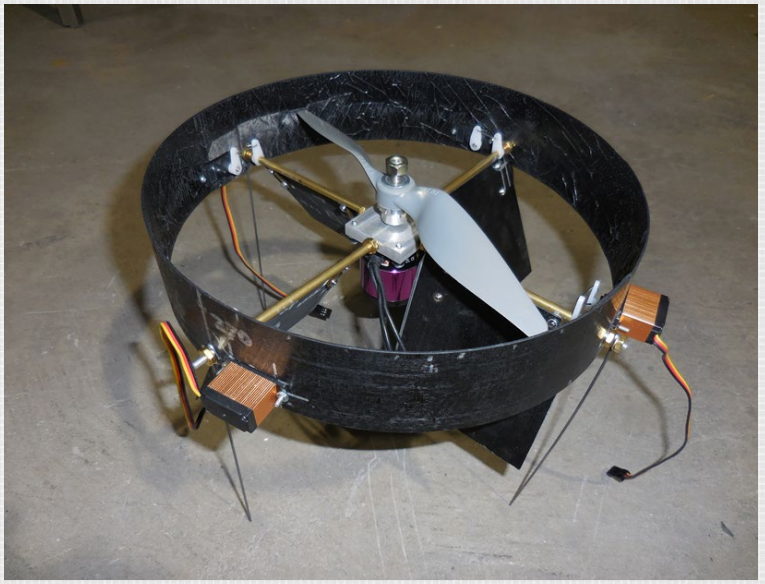
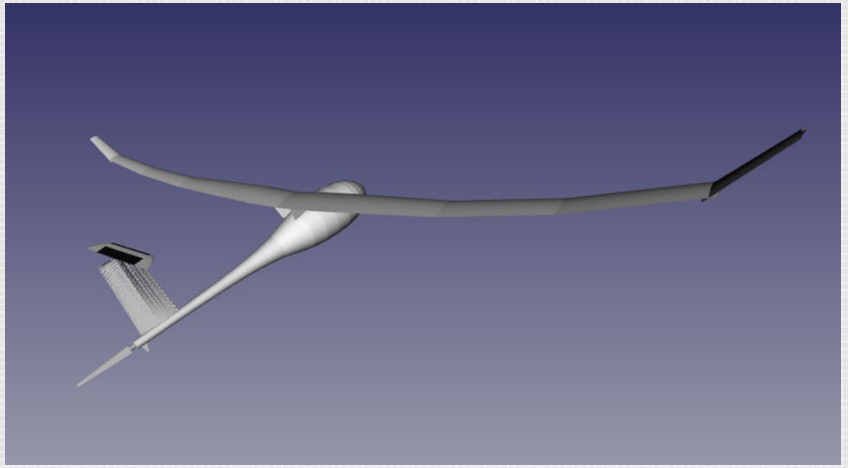
- Research Interests
  - Development of alpha and neutron detection devices for use on UAVs
  - Wireless engine speed controller design for alternative UAV fuels
  - Development of a single-rotor UAV that counteracts engine torque by using deflection of the flow
  - Indoor autonomous navigation of UAVs using ultrasonic distance sensors and accelerometer data
  - Aerodynamics and wing deflection of high-aspect ratio UAV airfoils under loading





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Dr. Sarah Harris
Associate Professor,
Department of Electrical and Computer Engineering

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- Research Interests
  - Digital design, reconfigurable computing
  - System on a chip design
  - Embedded systems
  - Robotics, interfacing sensors, actuation
- Recent Publications
  - Si, J., Harris, S., Handwritten Digit Recognition System on an FPGA. *IEEE 8th Annual Computing and Communication Workshop and Conference* (CCWC), pp. 402-407, January 2018.
  - Yfantis EA, Harris SL (2017), An Autonomous UAS with AI for Forest Fire Prevention, Detection, and Real Time Advice and to and among Firefighters. *J Comp Science Applications Information Technology* 2(3): 1-5.
  - Harris, S., Harris, D., Chaver, D., Owen, R., Kakakhel, Z., Sedano, E., Panchul, Y., Ableidinger, B. MIPSfpga: Using a Commercial MIPS Soft-Core in Computer Architecture Education, *IET Circuits, Devices & Systems Journal*, 2(4): 283-291, June 2017.
  - Hsiong, W., Huntzicker, S., King, K., Lee, A., Lim, C., Wang, J., Harris, S., Jahn, J., Performance and Area Tradeoffs in Space-Qualified FPGA-Based Time-of-Flight Systems, *International Conference on Electronic Measurement and Instruments*, August 16-19, 2009, Beijing, China.
  - Danowitz, A., Pinckney, N., Braly, M., Chen, H., Giles, A., Harris, S., Osofsky, S., Optical Distress Beacon for Space Use, *International Association for the Advancement of Space Safety (IAASS) Conference*, October 21-23, 2008, Rome, Italy.

Unmanned Aerial Systems Research

Dr. Ju-Yeon Jo

Associate Professor,
Department of Computer Science

Phone: (702) 895-5873

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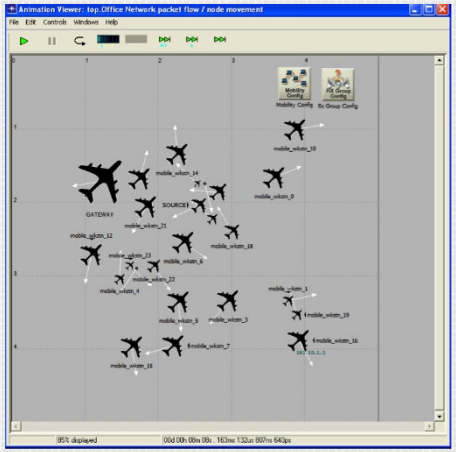
- Research Interests
  - Cybersecurity in UAS control software and ground systems
  - UAS communication network security
  - UAS privacy protection schemes
  - Software engineering in UAS system development



Unmanned Aerial Systems Research

Dr. Si Jung "SJ" Kim

Assistant Professor, Entertainment Engineering and Design

Digital Experience (DEx) Lab

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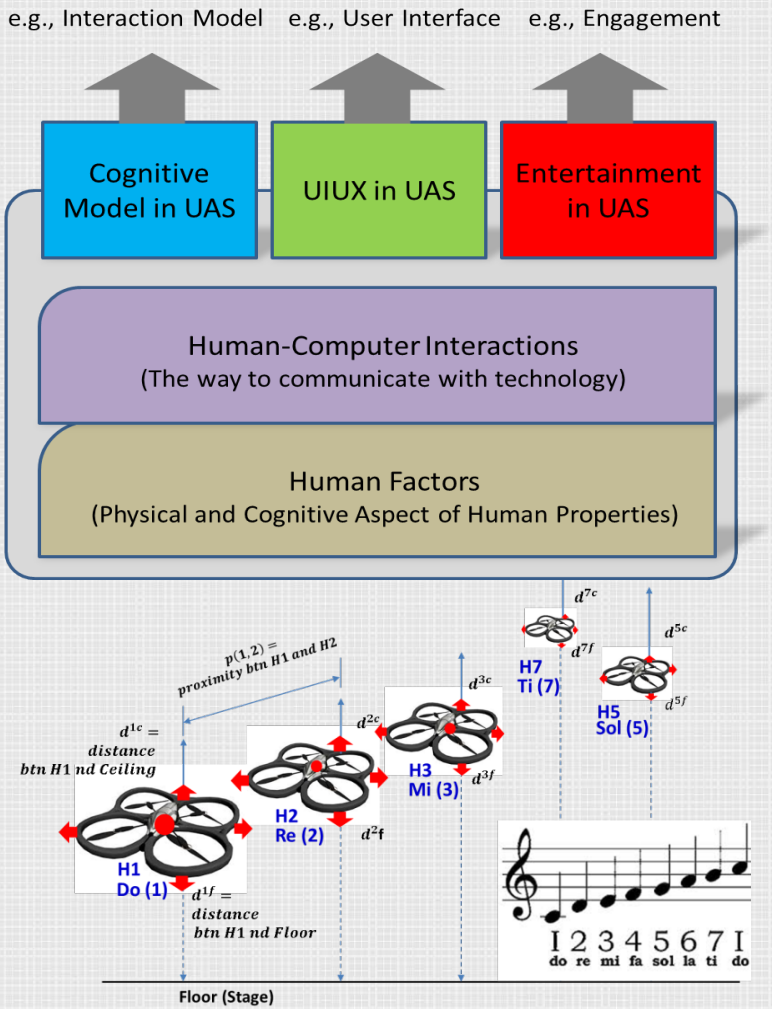
Website: http://sjkim.faculty.unlv.edu/

- Research Interests
  - Human factors and human-computer interactions in UAS
  - User interactions and user interface issues in UAS
  - Design and applications of user experience with UAS



The Flying Orchestra: Aerial robotic musical instruments providing novel user experience in live entertainment

Unmanned Aerial Systems Research

Dr. Yoohwan Kim, CISSP, CISA, CEH, CPT
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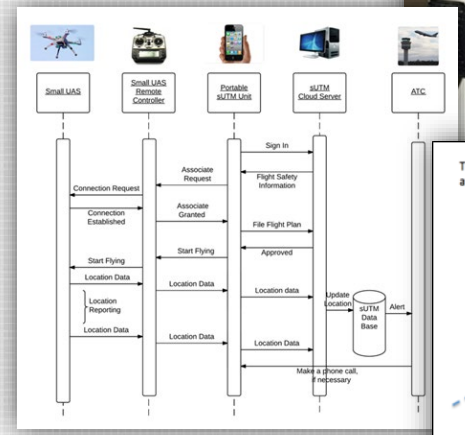
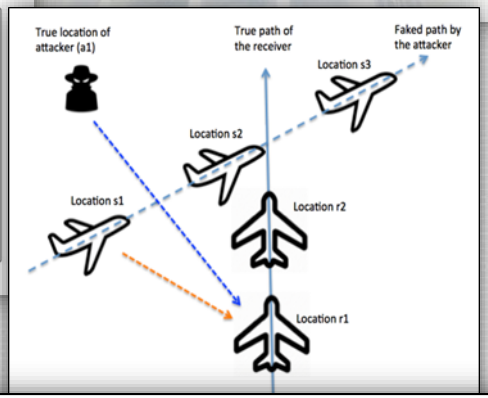
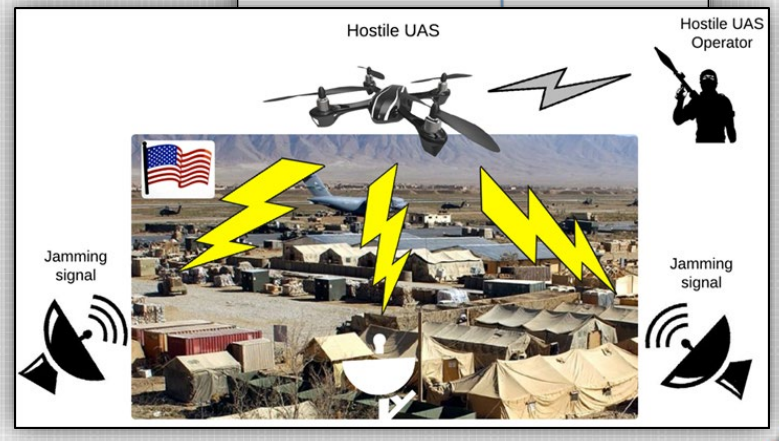




- Research Interests
  - UAS detection and tracking
  - UAS traffic management
  - UAS long-range communication
  - Protection against cyber attacks on UAS
  - ADS-B security for UAS



Unmanned Aerial Systems Research

Dr. Shahram Latifi

Professor, Department of Electrical and Computer Engineering
Director, Center for Information and Communications Technology (CICT)

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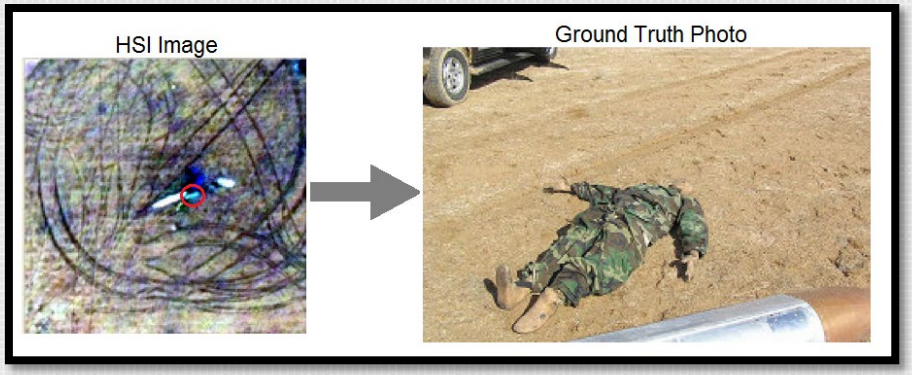
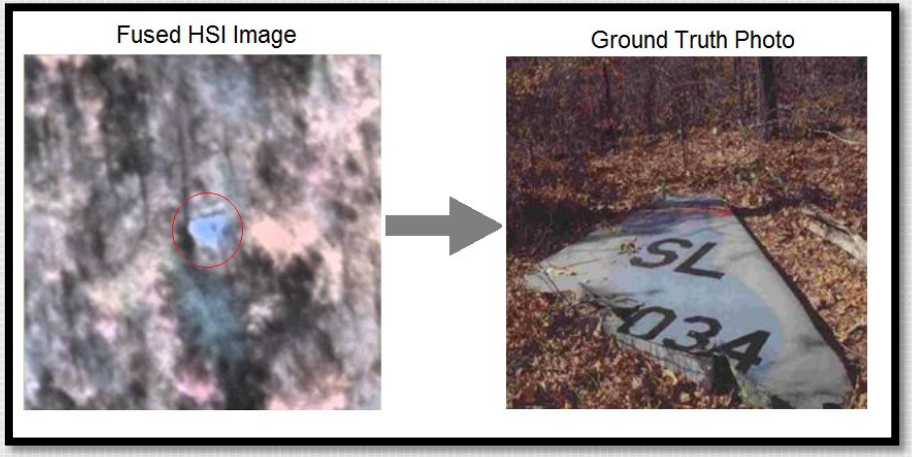
- Research Interests
  - Search and rescue technologies
  - Geolocation of RF emitters
  - UAS system health monitoring
  - UAS data acquisition and management





Unmanned Aerial Systems Research

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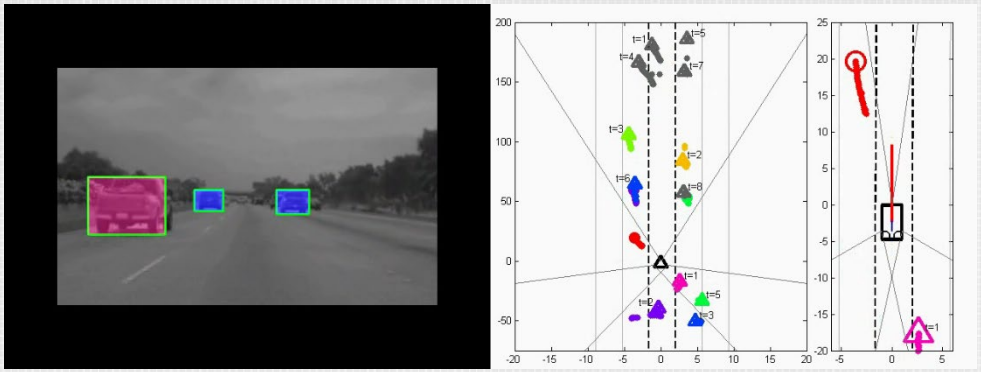
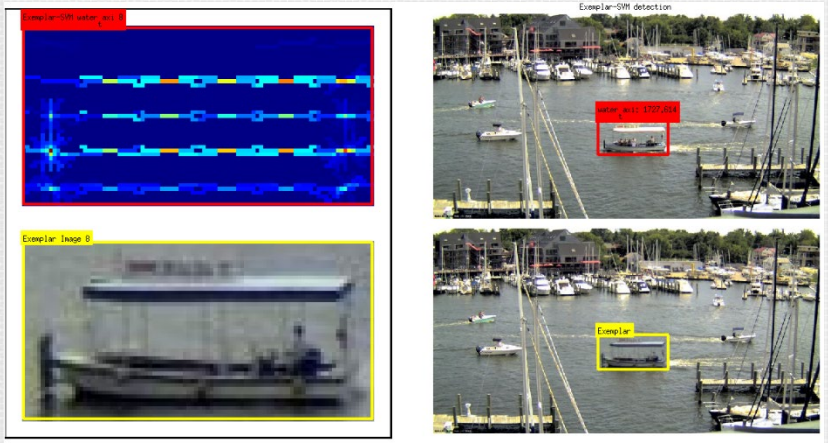


- Research Interests
  - On-board computer vision and image processing
  - Object detection and recognition
  - Selective filtering
  - Surround awareness
  - Sense and avoid technology



Unmanned Aerial Systems Research

Dr. Venkatesan Muthukumar

Associate Professor,
Department of Electrical and Computer Engineering

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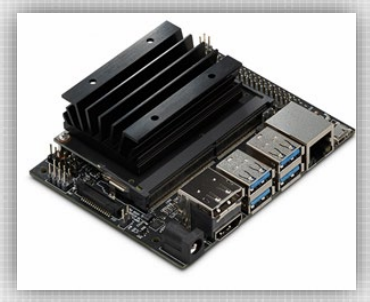
- Research Interests
  - Development and testing of large and heavy-lifting UAVs
  - Use of acoustics target identification and tracking for emergency response with UAV
  - Accurate target recognition and tracking with video stabilization using sensor fusion
  - On-board multi-sensor fusion, hardware acceleration of UAV tasks, altitude and flight control algorithms
  - Hardware acceleration and deep learning of acoustic signals and aerial images for UAV applications

Quark2 UAV application design

NAVIO2 integrated control design

UPBoard for hardware acceleration of UAV applications



Nvidia Nano for on-board deep learning

Unmanned Aerial Systems Research

Dr. Paul Oh

Lincy Professor of Unmanned Aerial Systems
Director, Drones and Autonomous Systems Lab
Professor and ASME Fellow,
Department of Mechanical Engineering

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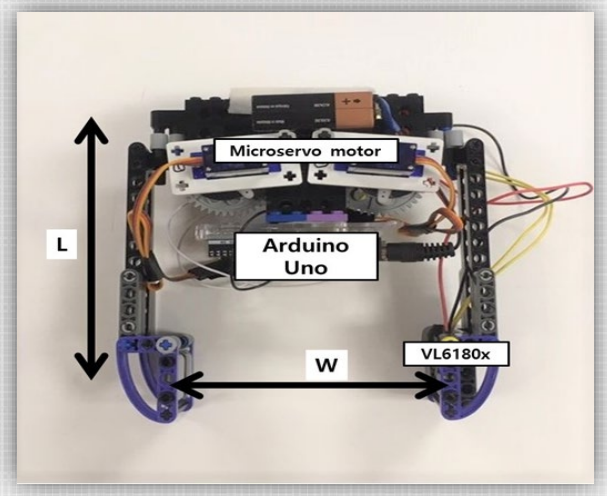
- Research Interests
  - Unmanned aerial vehicles
  - Autonomous systems
  - Robotics
  - Humanoids



Unmanned Aerial Systems Research

Dr. Emma Regentova
Professor,
Department of Electrical and Computer Engineering

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- Research Interests
  - Camera-based leader tracking and adjusting flight parameters
  - On-board calculation of the 3D position of the leader's relative speed, pitch, yaw and roll angles for following leader's path

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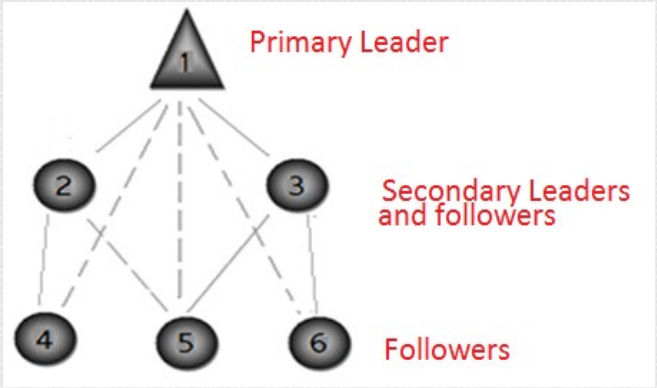

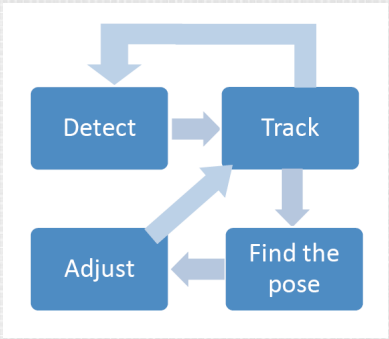

System flow

Initial pose | Position change | After alignment

Unmanned Aerial Systems Research

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Associate Professor,
Department of Electrical and Computer Engineering

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- Research Interests
  - Wireless communication systems and signal processing
  - Localization
  - Communication security
  - Sense and avoid algorithms
  - Privacy and blanking
  - Multiple vehicle networking
  - Sensors

Unmanned Aerial Systems Research

Dr. Evangelos Yfantis

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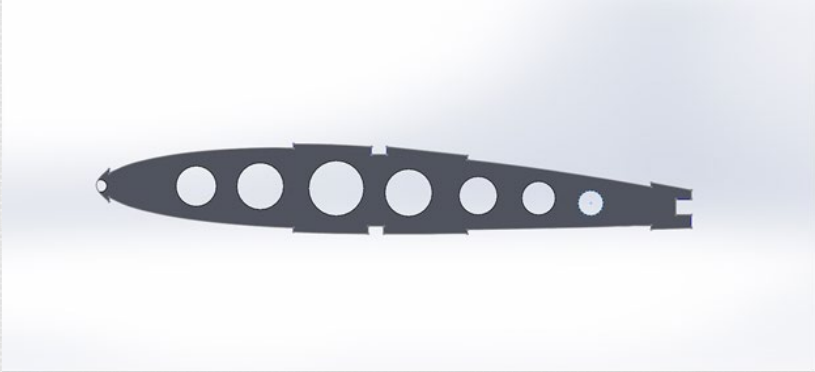
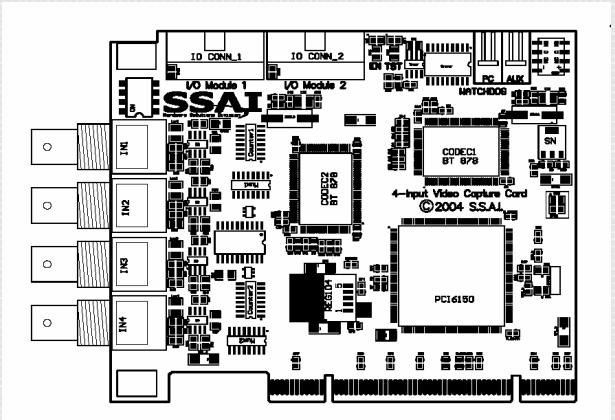
- Research Interests
  - Brushless electric motors
  - Video compression
  - Pattern recognition
  - Artificial intelligence
  - Signal processing
  - Multilayer authentication systems
  - Collision avoidance
  - Low-altitude high-endurance electric motors
  - Medium and high altitude high-endurance airplanes



Wing rib example designed and used in a low altitude, low Reynolds number, high-lift UAS



8-layer video capture, compression, and pattern recognition card, with PCI and PCI express data buses

Unmanned Aerial Systems Research

Dr. Woosoon Yim
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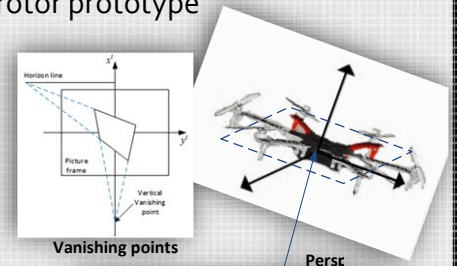
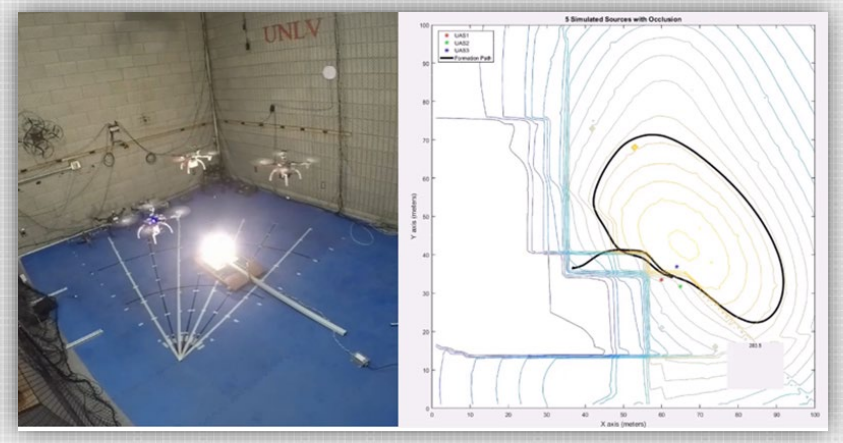
- Research Interests
  - Unmanned ground and aerial vehicle (UGV/UAV) coordination
  - Low-altitude radiation mapping by multiple UAVs
  - Aerial manipulation by fully actuated-multicopter

Fully-actuated hexrotor prototype





Low altitude mapping by UAV swarm

Unmanned ground and aerial vehicle (UGV/UAV) coordination control scheme