Dr. Mao Zheng
Oct. 2024

https://www.cs.uwlax.edu/~mzheng

Research Interest

- Software Engineering
  - Software Testing
    - Specification-based testing(formal model, automation)
    - UML testing (informal model, scenario-based)
  - Software Model & Software Design
    - Context-aware computing
      - Context models
      - Design and implementation based on the model
      - Context-aware applications: mobile apps.

Past Projects

Machine Learning	Mobile App Development	Software Engineering
Building a Stock Machine Learning Model using Numerai Dataset	Workout Track & Plan App	Launch Web Tool Document Generator from Legacy tool Spectrum to Generate Equipment Submittals
A Detection Tool for Traffic Objects	An Android App for Detecting Sleep and Pausing Media	
Tongue Diagnosis in Diabetes by Deep Learning	An Android UWL Campus Guide App (kotlin)	Test Case Generation from UML Models
Developing an Autonomous Driving Model Based on Raspberry Pi	A Ride Sharing Application: UberLite	A Web-based Testing Tool
Using Machine Learning to Play the Game Super Mario Kart	Context-based Mobile User Interface	A Design of the Test Engine
A Web Application for Restaurant Recommendations	A Mobile Application for Collecting Plant Observation Data	
A Web-based Application for Optimal Inventory Redistribution	An Android UWL Campus Guide App (Java)	

Current Projects & Future Ideas

- Refactoring “DataTracker” a Database Management Application
- A Predictive Model to Analyze Stock Trends and Make Future Predictions
- A Web Application for Sales Forecasting

Looking for Students:

- Mobile App Development: Kotlin or React Native
- Software Models, Design, or Testing
- Machine Learning

Research Areas

1 Human-Robot Interaction

How do we enable robots to utilize humanlike behaviors?

How can we successfully introduce robots into our everyday environments?

2 Comp Sci Education

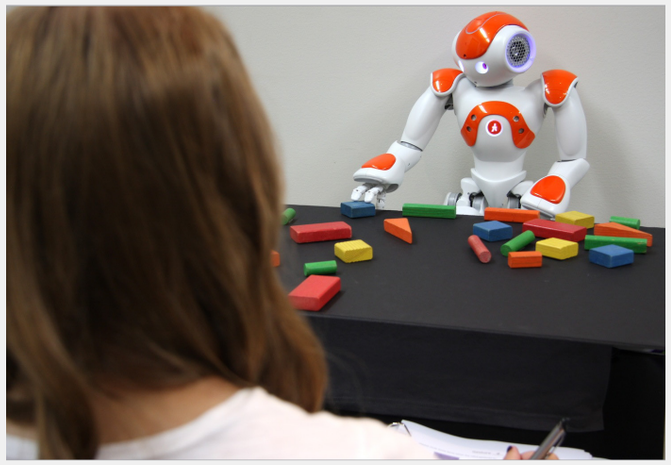
How can K-12 education best incorporate CS education?

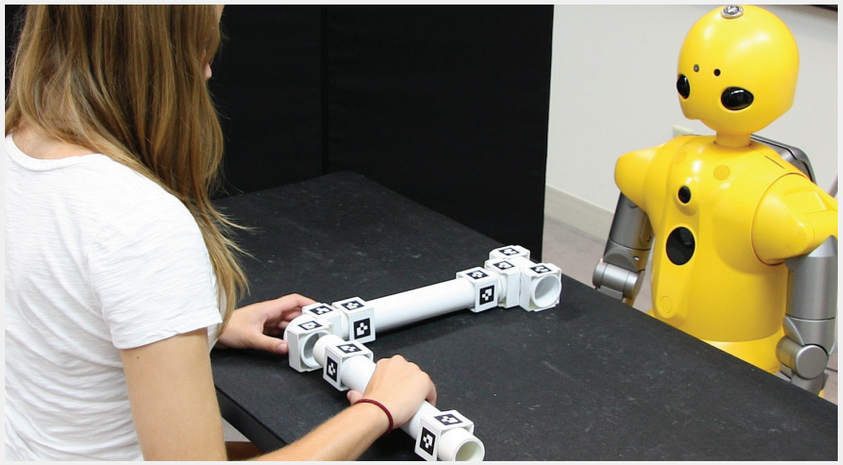
What is the impact of computer science education on the population, including the absence of it?

photo credits: huffpost.com; inverse.com

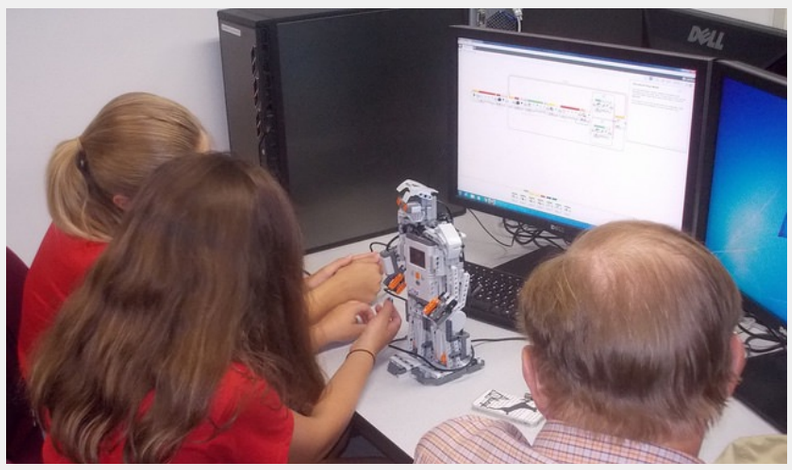
Previous Work

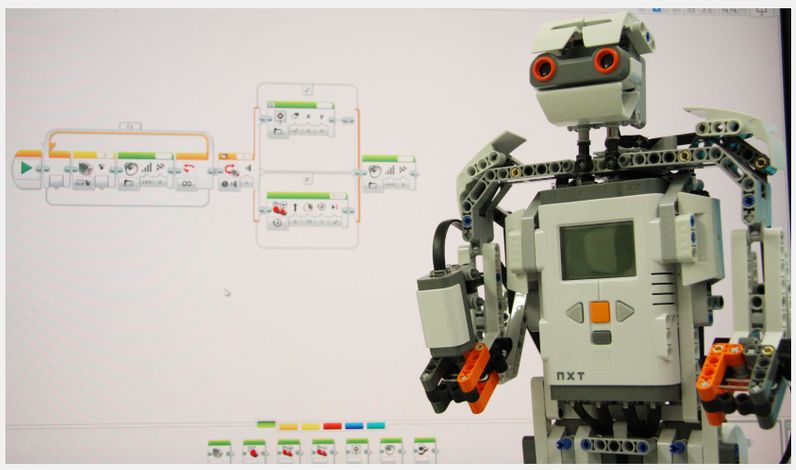
1 Human-Robot Interaction

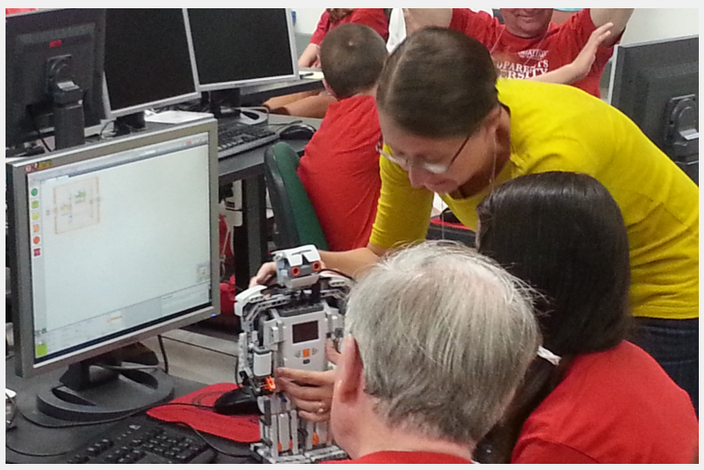




2 Comp Sci Education







Current & Future Projects

1 Human-Robot Interaction

Can we develop provably correct models of humanlike behavior that programmers of robots can use?

2 Comp Sci Education

How can we help homeschooling families and students integrate CS into their curriculum?

1 + 2

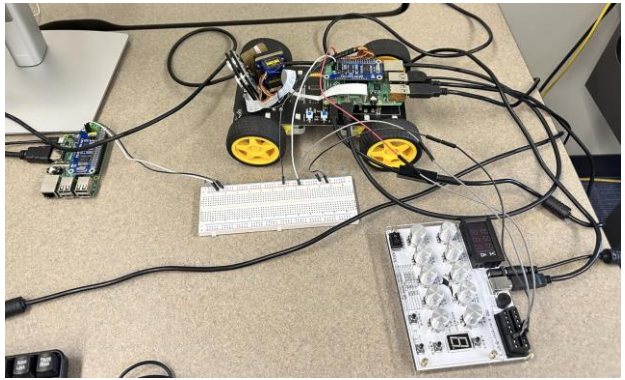
Manufacturing workers are envisioned as overseeing fleets of robots, rather than being replaced by them. What tools can we develop for these non-traditional students to aid in the computational education necessary for this role?

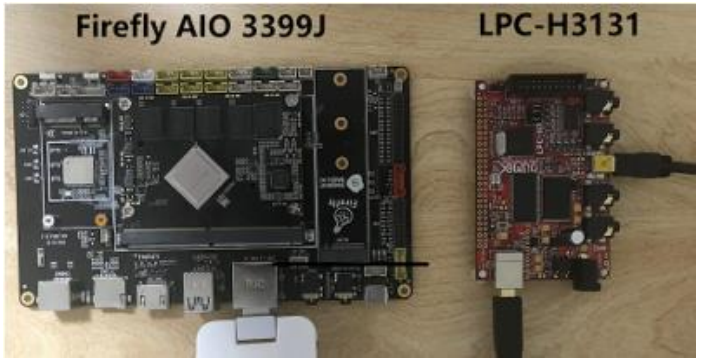
Lighting Talk

Niusen Chen

Research Interests

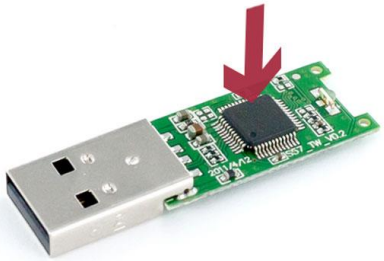
- Flash memory security
- Connected and Autonomous Vehicles (CAVs) security

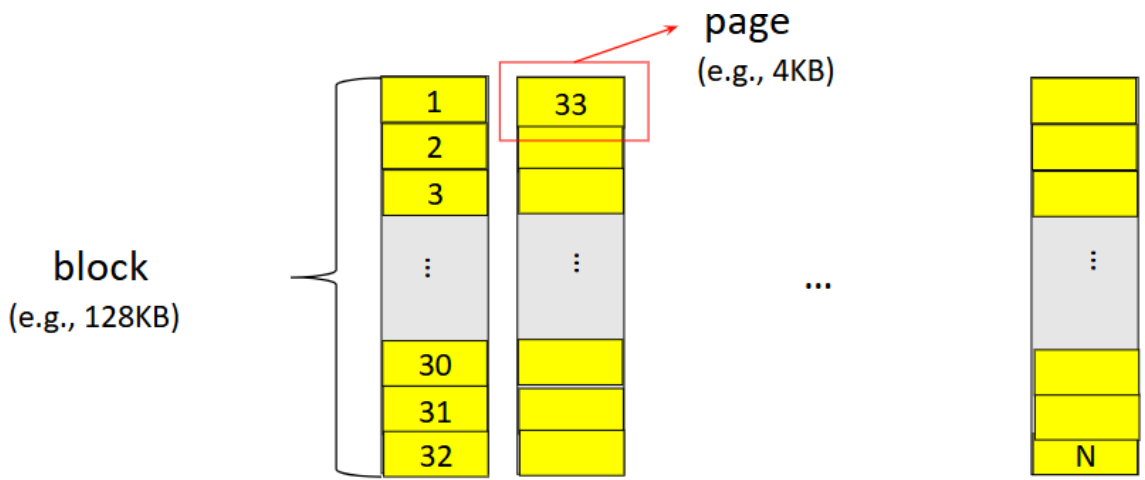




NAND Flash is Usually Used as Storage Media

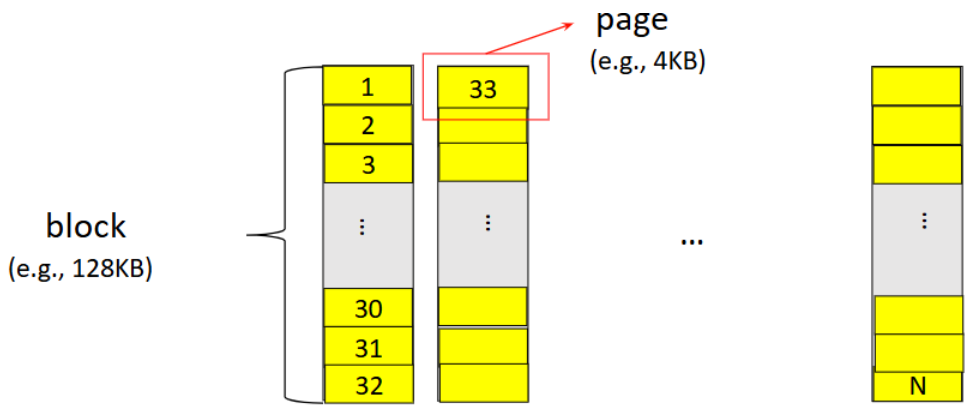
- NAND flash
  - USB sticks
  - Solid state drives (SSD)
  - SD/miniSD/microSD/eMMC





Hardware Characteristic of Flash Memory

- Read/Write on pages, but erase on blocks
- Erase-before-write
- Out-of-place update
- Limited number of program/erase (P/E) cycles



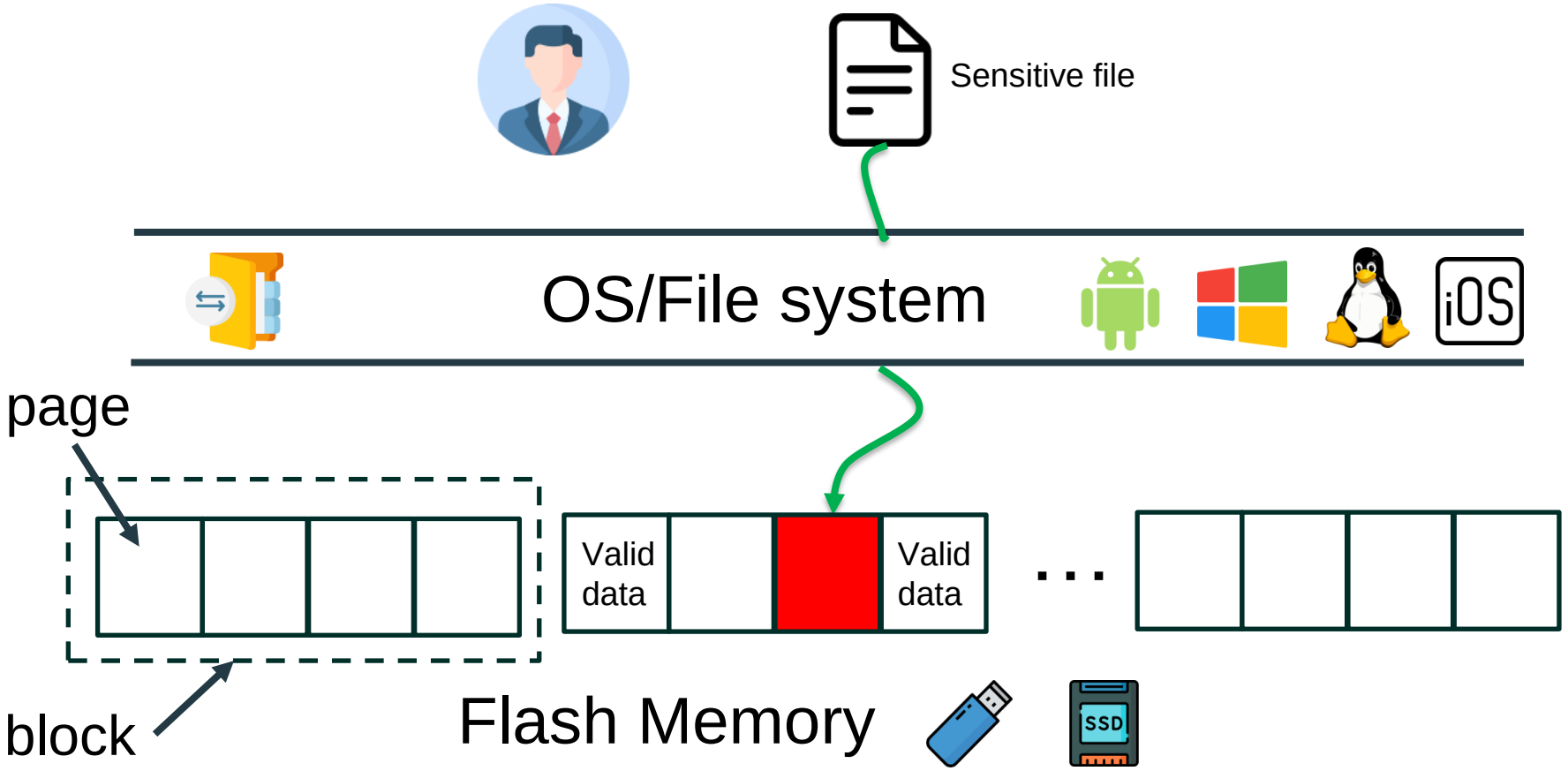
Special Functions in Flash Storage Devices

Garbage Collection: Blocks containing too many invalid pages will be reclaimed by copying valid data out of them, and the reclaimed blocks will be placed to free block pool to be reused.

Wear Levelling: Distribute writes/erasures evenly across flash memory.

Bad Block Management: A flash block may turn “bad” over time and cannot reliably store data. Bad block management typically introduces a bad block table to keep track of bad blocks. Once a block turns bad, it will be added to the bad block table and will no longer be used.

Secure Deletion in Flash Memory

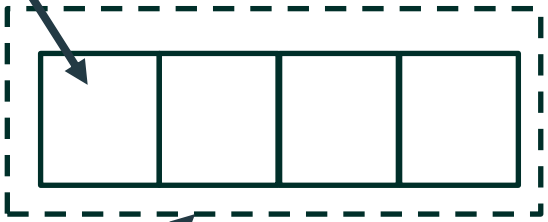


Secure Deletion in Flash Memory (cont.)

Sensitive file

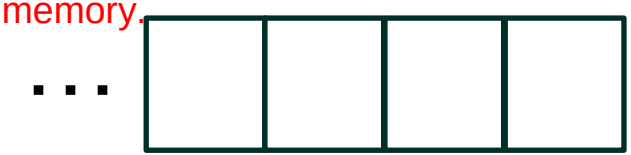
OS/File system

page



block

Sensitive data may still be temporarily retained in storage due to the unique characteristics of flash memory.



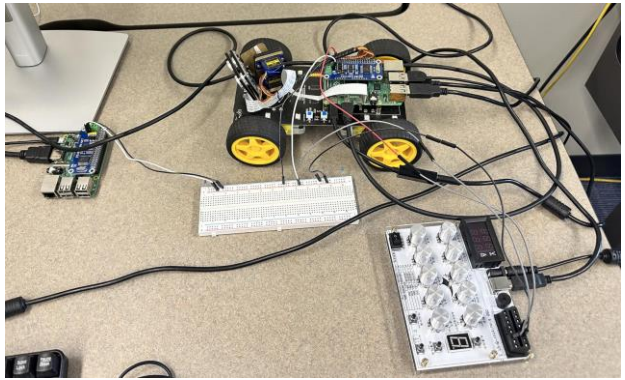
Flash Memory

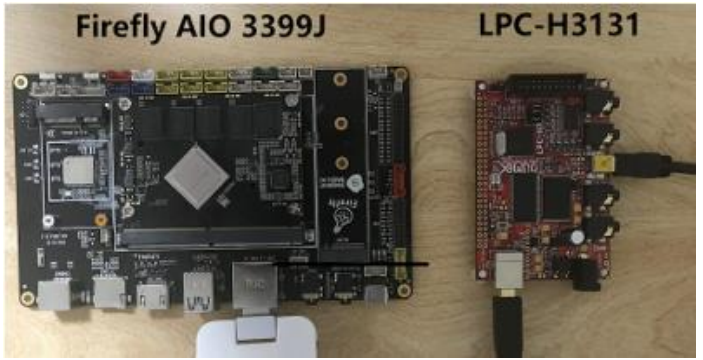
- Secure deletion by managing remnants produced by flash storage firmware
  - How can internal functions of firmware create data remnants that compromise secure deletion

- Secure deletion by managing remnants produced by flash storage hardware
  - Can we identify any remnants at the voltage level of NAND flash after block erasure
  - Are there any data remnants present at the internal processor caches and the memory

Research Interests

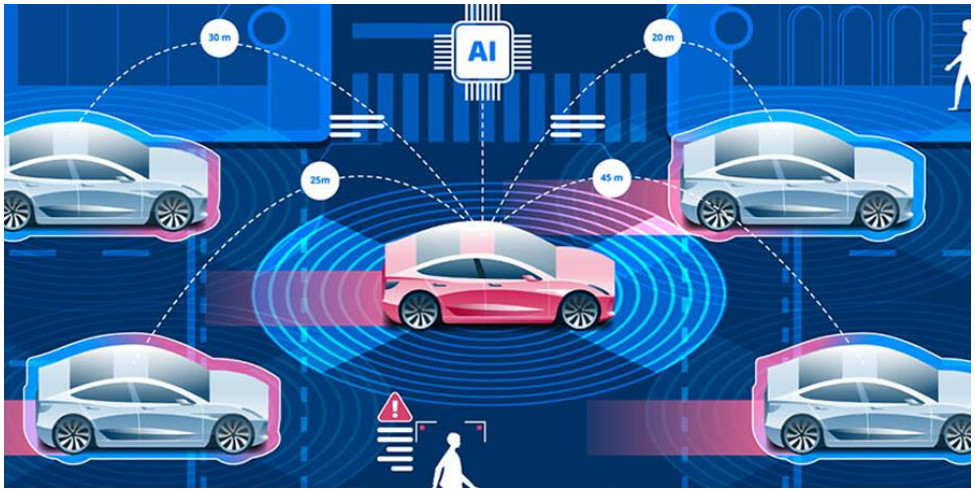
- Flash memory security
- Connected and Autonomous Vehicles (CAVs) security





CAVs Security

- CAVs will help humans achieve safe, efficient, and autonomous transportation system
- The risk of cyber threats on smart vehicles is increasing



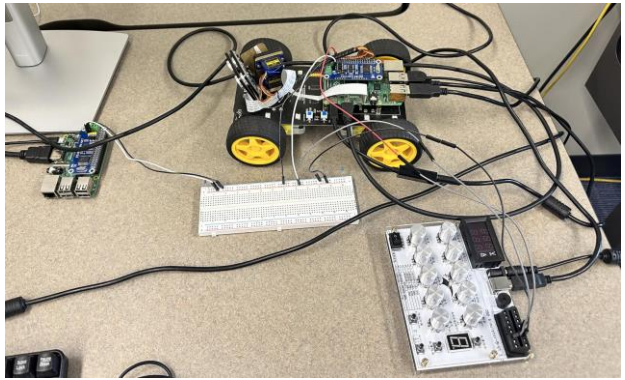
CAV is Vulnerable to Several Attacks

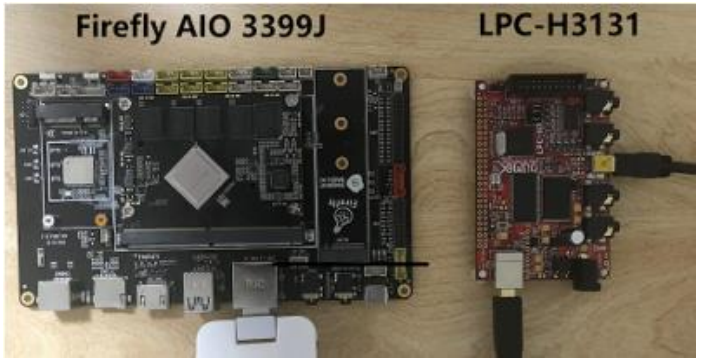
- 170 attacks reported on CAVs from 2010 to 2018 (60 in 2018)
  - Remote hack through infotainment
  - CAN access through OBD-II (remote or physical)
  - LiDAR/Radar Spoofing
  - Network denial of service

- Attacks on electronic control units (ECUs)
  - ECUs are widely deployed in CAVs
    - Fuel supply, brake system, ignition, idle speed, etc.
  - Malicious entity gains access to the CAN
  - Inject malicious code into the internal firmware of ECUs

Research Interests

- Flash memory security
- Connected and Autonomous Vehicles (CAVs) security





Thank you!

Dr. Dipankar Mitra

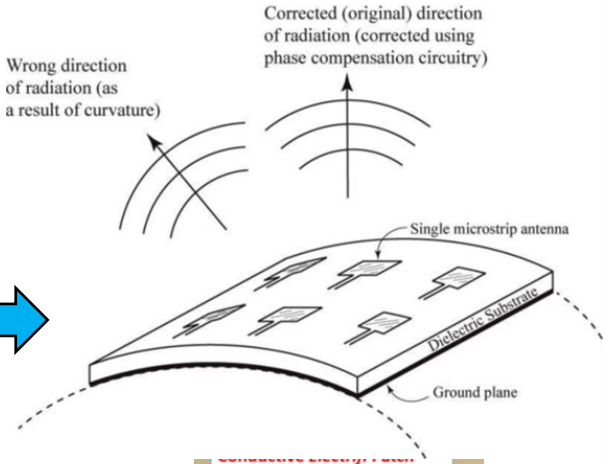
Assistant Professor

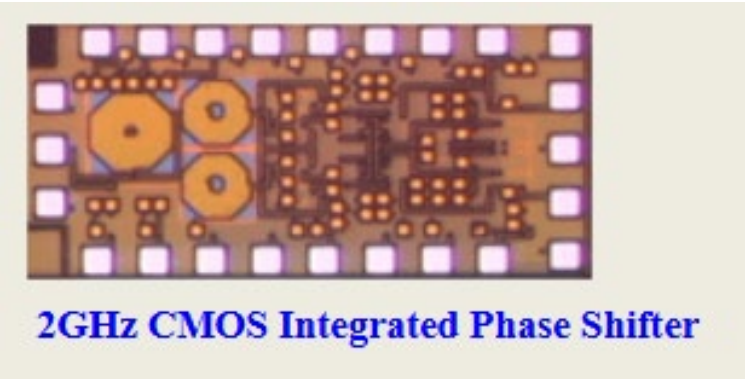
Dept. of Computer Science & Computer Engineering

University of Wisconsin-La Crosse

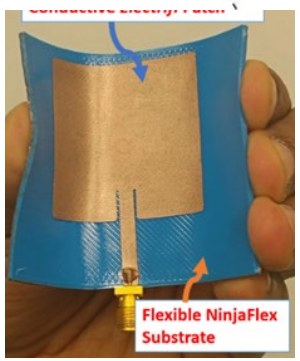
Research Background

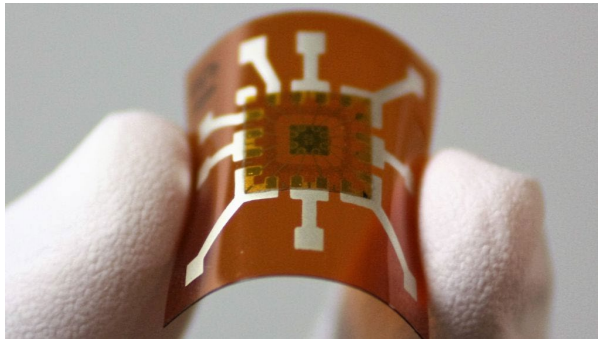
- **CMOS Integrated Beamformer for Phased Array antenna**



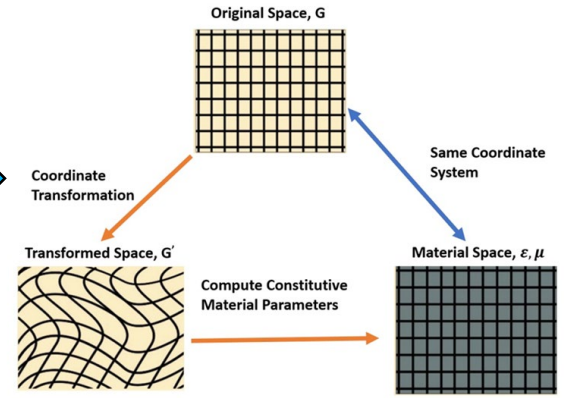


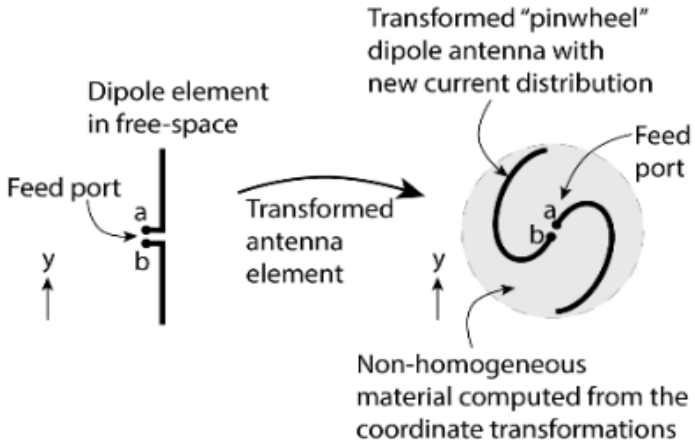
- **3D-Printed Flexible and Wearable Electronics**





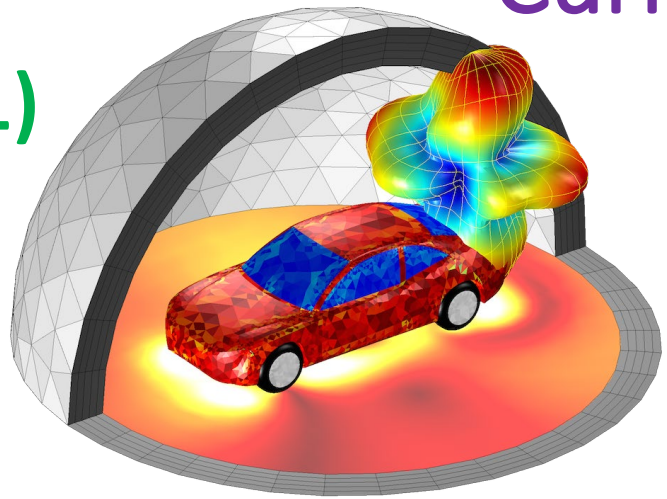
- **Transformation Electromagnetics/Optics**





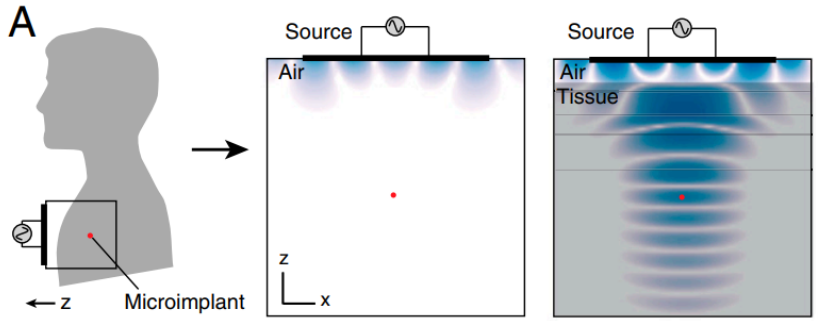
Current and Future Research

(1)



Real Environment Antenna Simulation using COMSOL Multiphysics

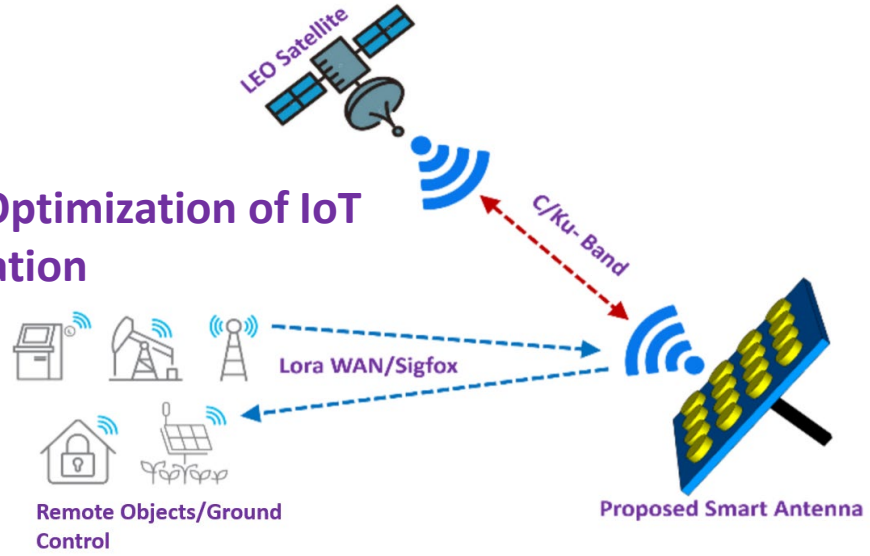
(2)



Near-Field Sensing for various Biomedical Applications (Collaboration with Mayo)

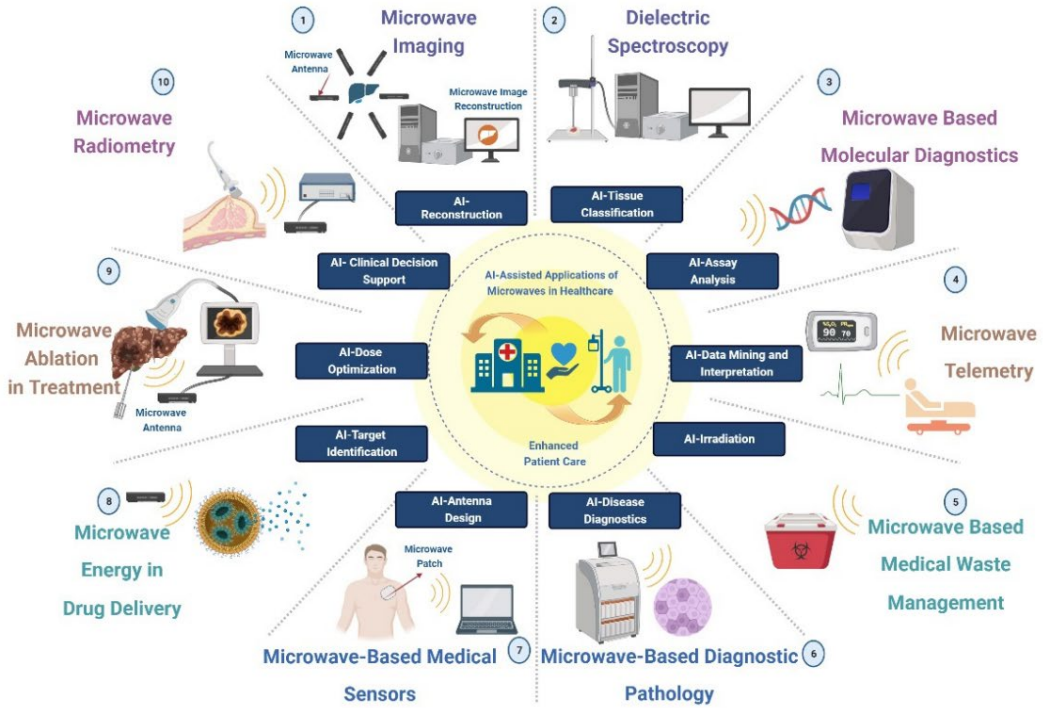
(3)

ML-based Optimization of IoT Communication



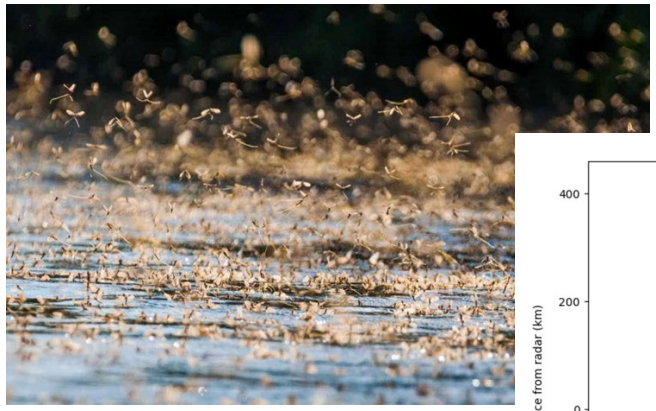
Current and Future Research

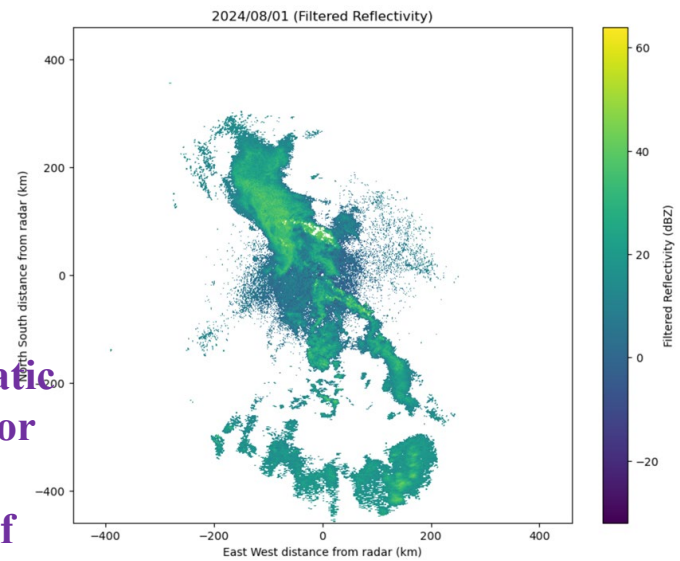
(4)



AI Applications of Microwaves in medicines for Better Health Care (Collaboration with Mayo and Gundersen Health)

(5)



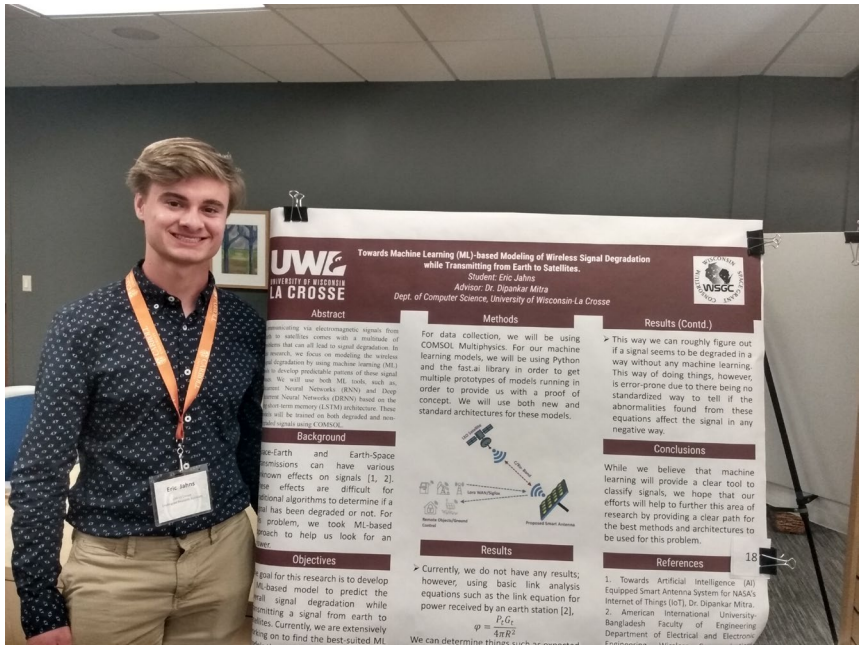


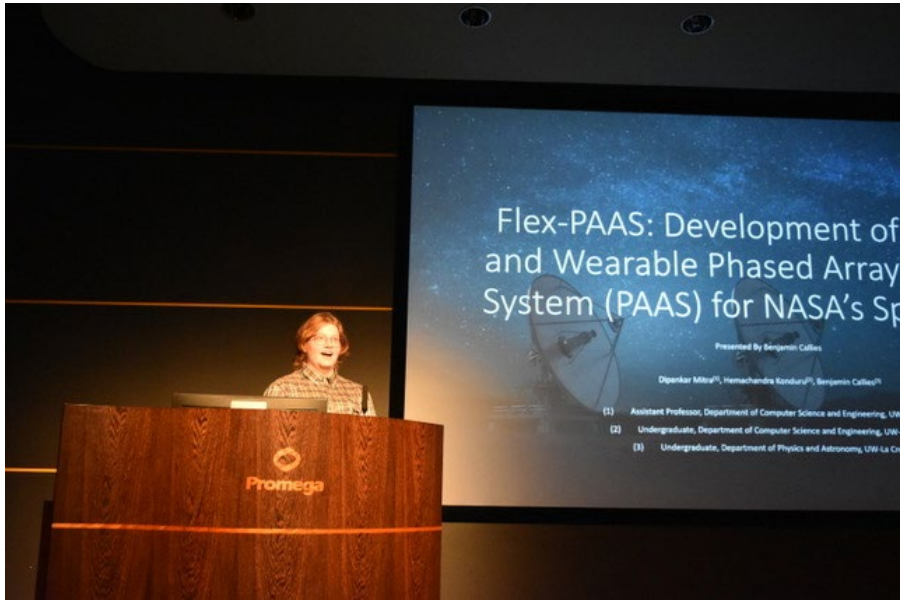
ML-based prediction of aquatic insects (MayFly) in UMRR for predicting water health (Collaboration w/ WI Dept of Natural Resources)

Scope and Potential Opportunities:

- **Learn Industry scale CAD Tools: COMSOL, CST, ADS**
- **Internship Opportunities @ Mayo Clinic, Patfoci Technologies Inc., Rochester, MN, NASA WSGC**

Student Success





- Two UG Students went to Grad School (ASU and UBC)

- 2 Dean's Distinguished Fellowship (DDF) in Summer, 2023

- 4 went for Internships in Top Companies (Summer 22, 23, and 24)

-Currently, 4 students working on different Projects

-Students Published in IEEE Papers

- One Student Co-authored a Book Chapter With me

Research Sponsors

- NASA Wisconsin Space Grant Consortium (WSGC)
- UWL FRG
- Gundersen Health Care
- WiSys Ignite and Spark
- Microwave and Imaging Lab (MEIL), Department of Medicine, Mayo Clinic, Rochester, MN
- Potential Support from: NSF, Wisconsin Innovation Grant, WI DNR

Prof. Samantha Foley

Research Interests

- Scientific Computing
- High Performance Computing
- Cloud Computing

Past Projects

- Past MSE Projects
  - DSLEUTH – parallelize an urban growth modeling program to run on multicore machines
  - KSLEUTH – using the same approach as DSLEUTH, but using Kubernetes and Docker containers
  - PySLEUTH – reimplement the SLEUTH code in a modern language
  - OnRamp – a web portal for running parallel programs for education
  - Concurrency Visualizer – a web application that demonstrates classic synchronization programs with a backend written in Go
  - Suite of GPU applications for learning about parallel computing

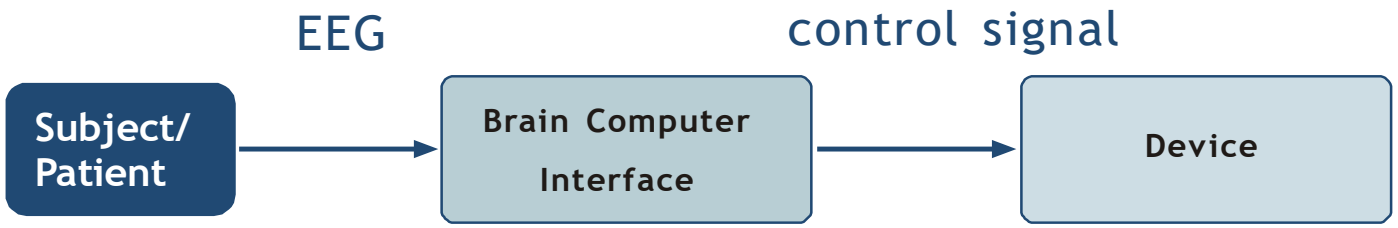
Current and Future Projects

- ***Concurrency Visualizer***
  - extend the work with more applications and more powerful visualization of the results
- ***PySLEUTH (high-performance and Python versions of SLEUTH)***
  - Current work:
    - reimplement in Python
    - use DSLEUTH on larger datasets in the meantime
  - Future work:
    - understand the performance when working with much larger data sets
    - Automate calibration steps
- ***Other projects dealing with parallelism, containers, and chatbots***

Dr. Rig Das
Assistant Professor
Department of CS & CE

Brain Computer Interface

What is Brain Computer Interface (BCI) ?



- Definition: Direct communication pathway between the brain and an external device.
- Focus: Non-invasive BCI using EEG signals to control drones.
- Applications: Neuro-rehabilitation, assistive devices, UAV control.

Overview of EEG-Based BCIs

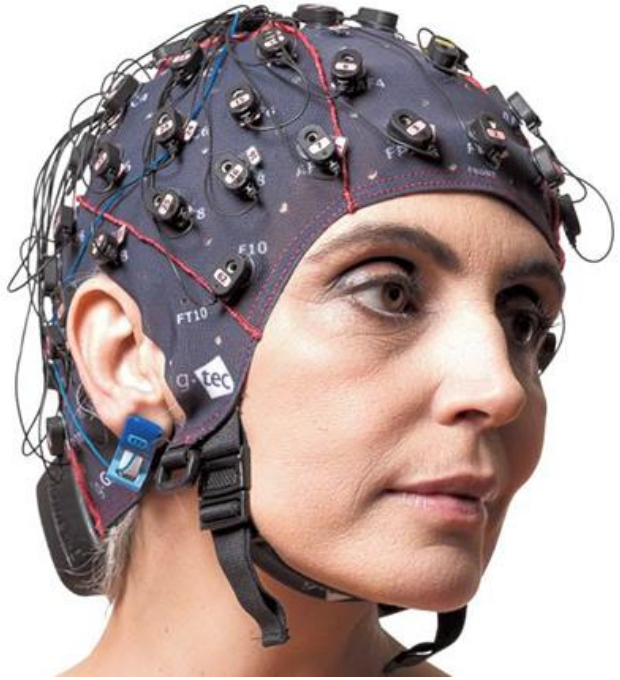
- EEG (Electroencephalography): Measures brain activity via electrodes on the scalp.
- Advantages: Non-invasive, portable, real-time data acquisition.
- Limitations: Signal noise, need for robust signal processing technique.

Brain-Computer Interface for Drone Control

- Imaginary Movements:
  - Left Hand: Move drone left
  - Right Hand: Move drone right
  - Both Feet: Ascend/Descend
  - Tongue: Forward/Backward motion

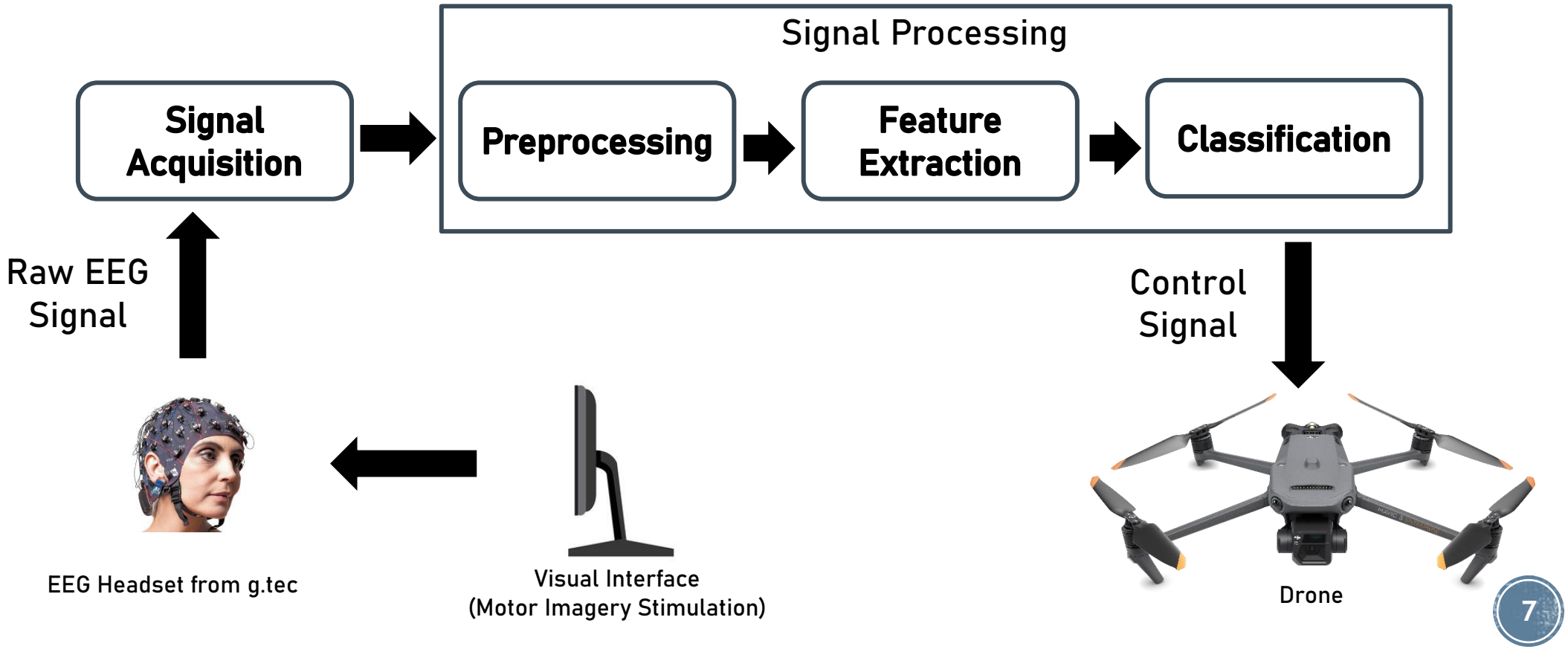
- Advantages of Using Motor Imagery: No physical movement required; enhances control for individuals with limited mobility.

EEG Acquisition Device



g.Nautilus by g.tec System

Proposed BCI System

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