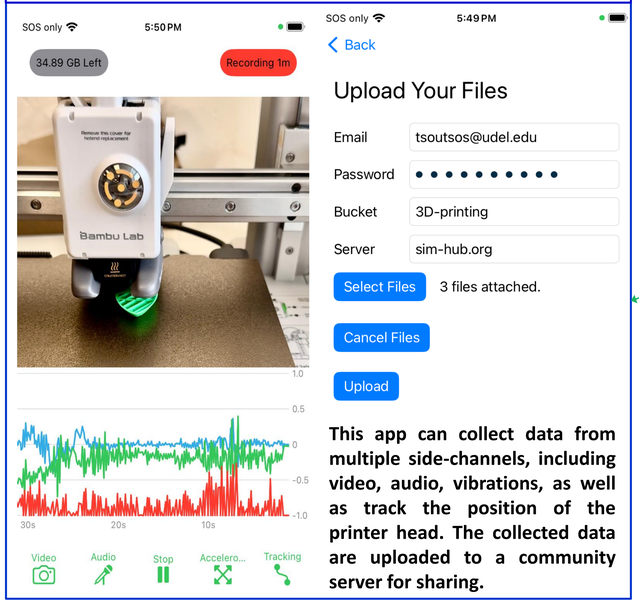
Data-Driven Cybersecurity Research Infrastructure for Smart Manufacturing

Smartphone App for Crowdsourced Data Collection



This app can collect data from multiple side-channels, including video, audio, vibrations, as well as track the position of the printer head. The collected data are uploaded to a community server for sharing.

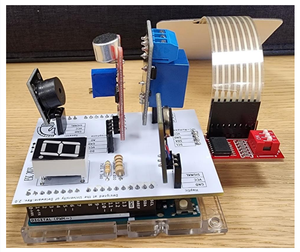
3D printers for data collection with anti-side channel features

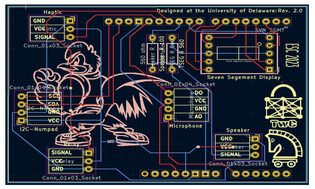
Vibration Compensation

Noise Cancellation

International competition on Cyber-Physical Systems

Embedded Security Challenge





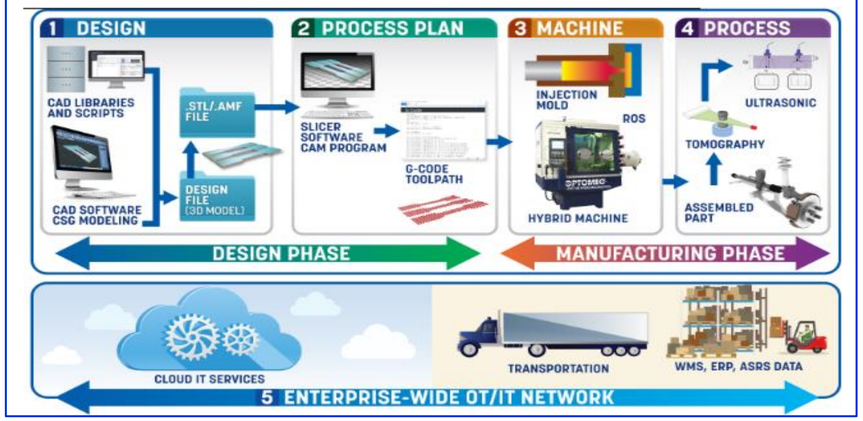
This year's ESC focuses on side channel attacks (SCA) on cyber-physical systems (CPS). The qualified teams are investigating a range of SCAs using a custom PCB and an Arduino Uno based CPS running several challenges that expose various side channels.

Research Vision and Mission

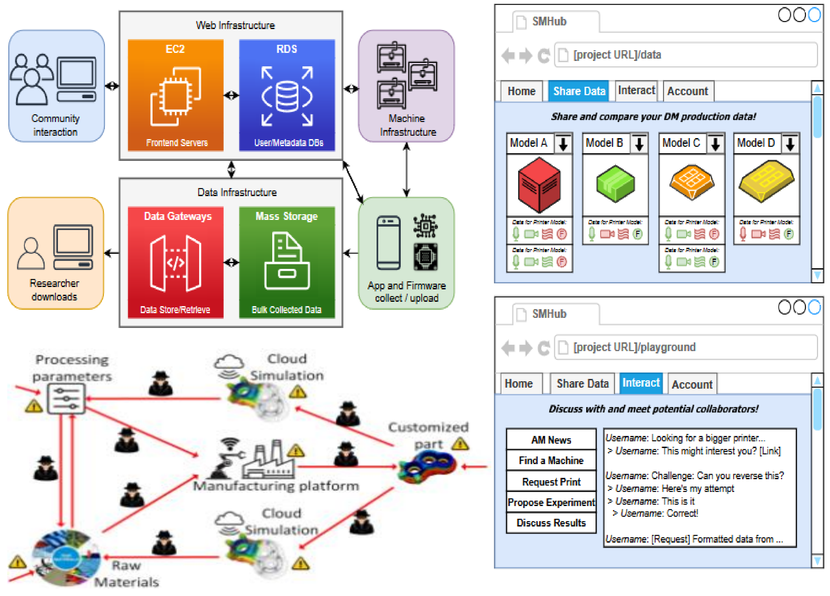
Creation of a Vibrant CISE Research Community for a Data-driven Cybersecurity for Smart Manufacturing (SM)

- Web Infrastructure
- Data Infrastructure
- SM Machine Infrastructure

SM Stages of Product Life Cycles and SM Hub



Community SM Infrastructure, SM Security Threats Risking Data Inputs and Communications with other entities, and SM Hub

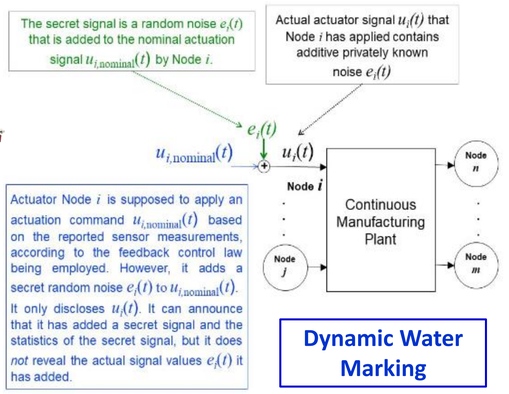


TAMU Smart Hybrid Machine (SHM) Platform

Siemens 828D Controller

Optomec MTS 500 Hybrid Machine

Digital Twin for Siemen's Sinumerik 828D Controller



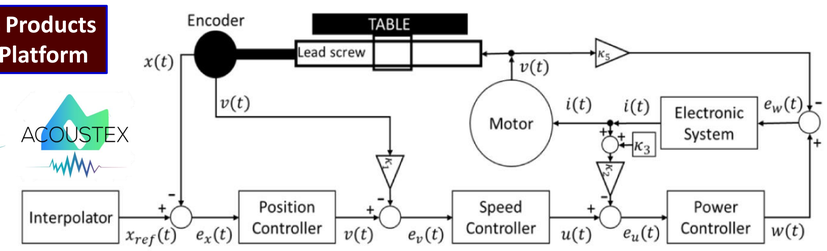
Dynamic Water Marking

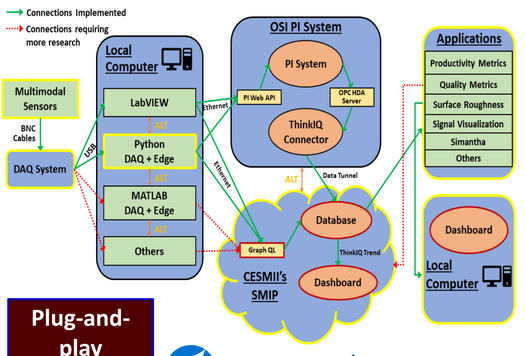
2 NSF i-Corps Products and 1 MaaS Platform

AlignAI FusionPro

ACOUSTEX

HiveAM designer





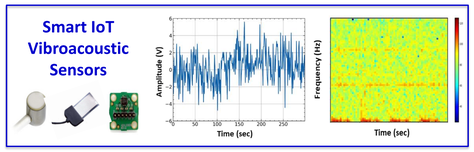
Plug-and-play Architecture with CESMII SMIP

OSIsoft. OPC UA

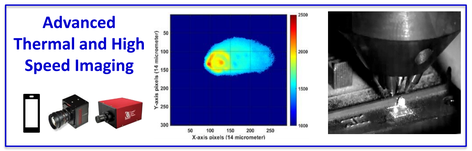
CESMII THE SMART MANUFACTURING INSTITUTE

Smart Sensor Wrapper (14+ channels)

Smart IoT Vibroacoustic Sensors



Advanced Thermal and High Speed Imaging

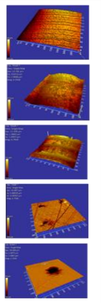
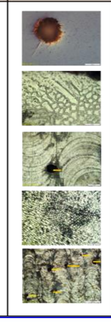
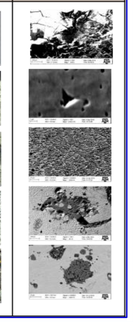


Machine Variable Logs via OPC UA Data Logger

Events

Event Log

Around 10 TB worth Multimodal Data from various printing materials and conditions

Data Source	Type of Data Collected	Data Rate (MB/min)	Data Volume (GB)	Characterization: 3D Optical Profilometer (800 KB per capture)	Characterization: Optical Microscope (10 MB per capture)	Characterization: SEM (1 MB per capture)
Accelerometer	Sensor time-series data via National Instrument's Data Acquisition System (NI-DAQ)	1.87	10			
Acoustic Emission		30	160			
Thin film		0.23	1.23			
Stratonics ThermaViz	In-situ melt pool history captured in form of raw frames and associated intensity-based data	1116	5972			
Photron High Speed Camera	High FPS (~6400) videos are recorded. Amount of time capture X FPS is always limited to < 174698 fames. For ex: At 5000 FPS, a 35 seconds of process will be captured.	1661	111			
Optical Camera	Process history captured via smartphone at 30/60/120 FPS	26.88	143			
Open Platform Communications (OPC)	Machine Log data keeping track of various machine variables such as XY coordinates of the table, status of the spindle, etc. in form of an Excel-based log	0.02	1			

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