Smart Systems HyFlex Workforce for Ecosystem of Small Medium Enterprises, ManufacturingUSA, CHIPS

WEDNESDAY, July 31, 11:15-Noon



Sam.Samanta@flcc.edu

www.flcc.edu/SST



Smart Systems HyFlex Workforce for #HighTechEcosystems

Overview

Bootstrapping Digital Transformation of Smart Systems Technologies degree and **HyFlex scheduling**, we **broadened access** for

- Conventional and PTECH students
- Remote students
- Incumbent workers
- Underemployed baccalaureates

Paid co-ops matched with needs of 50+ businesses in a high-tech ecosystem

- High rates of completion (75 percent)
- Job placement (~100 percent)

Efficient blueprint for sustainably meeting

- Current high-tech workforce needs for 98 percent of employers
- Workforce ramp-up challenge for advanced manufacturing technologies accelerated by the Manufacturing USA Institutes and reshoring initiatives of the CHIPS Act.

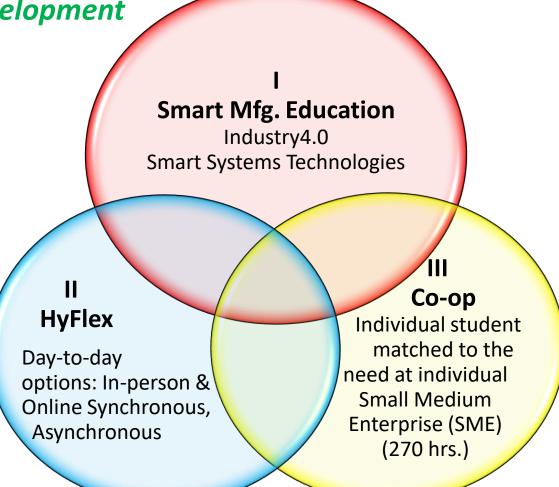
Smart HyFlex Education for High-tech Ecosystem

AAS Degree in Smart Systems Technologies / FLCC

Smart Manufacturing (SM) Workforce Development

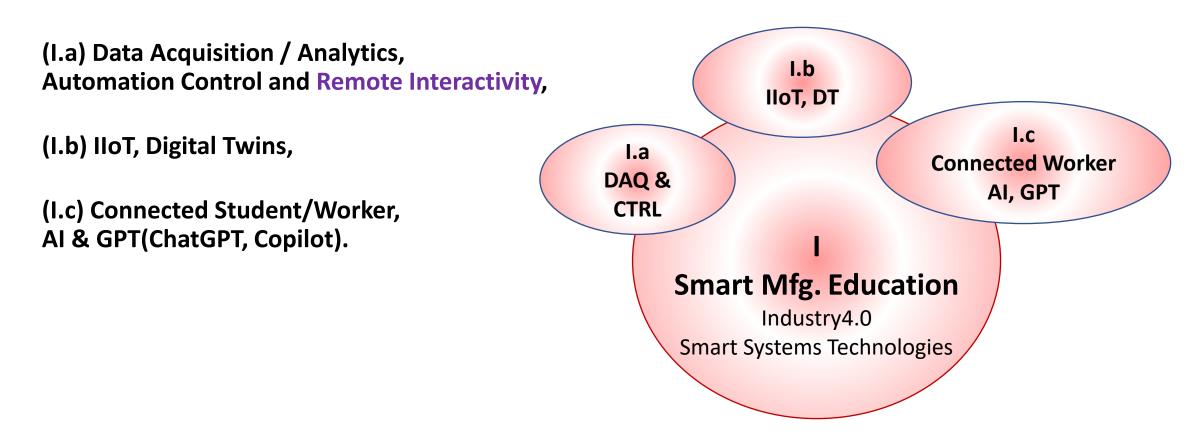
- SM education for traditional students and PTECH <u>Pathways Technology Early College High School</u>
- Option for Engineering "drop-outs"
- Up-skill incumbent workers
- Re-skill underemployed baccalaureates
- Aligned with imperatives of CESMII, ManufacturingUSA and the CHIPS Act.





Smart Manufacturing Education (I)

- Knowledge, skills, and abilities (KSAs) for success in Industry 4.0.
- Integrate and extend SMLS, hands-on experience with real-world mfg. scenarios.

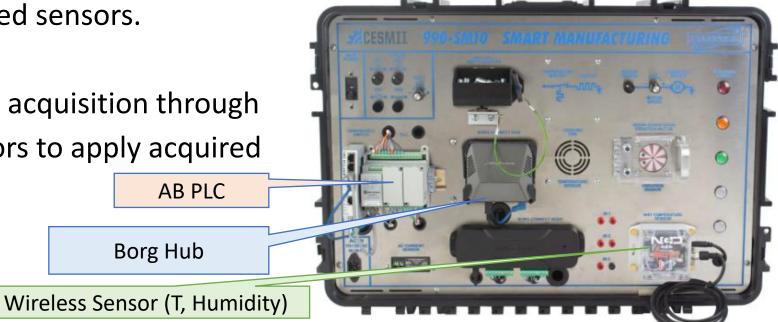


I.a CTRL Smart Manufacturing Learning System (SMLS)

Amatrol 990 – SM10 (Developed with CESMII)

Allen-Bradley Micro820 controller acquires data through a variety of embedded sensors.

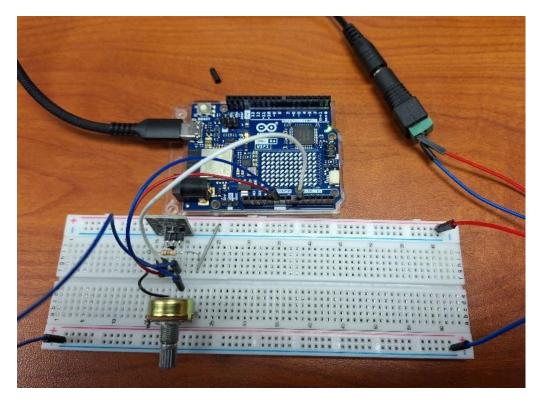
Extended our work with data acquisition through embedded and remote sensors to apply acquired data to control processes. AB PLC



Funded by CESMII Grant for developing Learning Resources for Community Colleges and Incumbent Workers. Co-PI: Paul Perkins, President of Amatrol

I.b Extending SMLS Capability Arduino Wi-Fi R4 Integration with Mosquitto Broker

.. for Web-Based Sensor Data Display



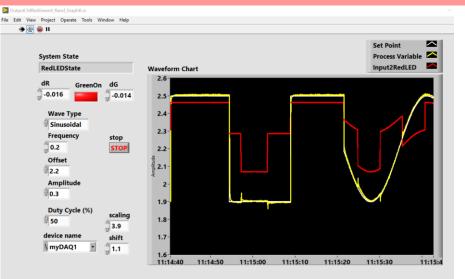
Objective:

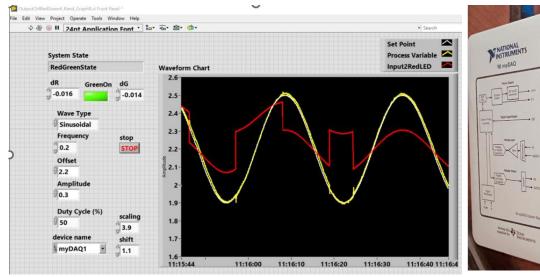
Leverage inexpensive sensors using Mosquitto MQTT broker running on SMLS Borg Hub.

I.c Lab Tabletop Digital Twin (at Edge)

DutputCtrlRedGreen4_Rand_GraphR.vi Block Diagram

"Digital Twin" using myDAQ, LabVIEW, Excel





Smart Systems HyFlex Workforce for #HighTechEcosystems



File Edit View Project Operate Tools Window Help Q 🤉 🔜 수 🏵 🛑 🛛 💡 👷 🛥 🖬 🕩 24nt Application Font 🔨 🎰 🎰 🔅 🐄 Search GreenOn ETE Numeri 132.1 Wave Type DAQ • "Square" 0. Assistant2 Offset data Frequency Ú. 8:10 Duty Cycle (%) 2.2 8:10 Amplitude Latr 2 Simulate Signal₂ 0.5 DAQ Assistant RedGreenState System State device nar device name Dabe error in DEV stop (T) RedLEDState imeout Waveform Chart data error out shift scaling stop DBL

Digital Twin Two-way transfer of data Physical System <=>Digital Model

(Not using PID Ctrl)

Information Technology (IT) and Operational Technologies (OT) Bridges

Remote Access

Remote Access for Students

For HyFlex scheduling & for those out of driving distance to our lab, are provided remote access to selected lab systems via SSL-VPN.

- Security is addressed mainly via two factor authentication, and hardware limit on the systems.
- Remote Access for Outside Vendors
 Separated from rest of the college
 network, four Ethernet ports in our labs
 are on their own Virtual Local Area
 Network (VLAN).
- Outside personnel, such as known verified vendors, can be provided remote access through these isolated ethernet ports connected limited number of systems, such as the PLCs and Smart Manufacturing Learning System (SMLS).

HyFlex Scheduling (II)

Bootstrap Smart Mfg Tech to facilitate HyFlex / Remote Control of Systems

- Accommodates diverse learning preferences and schedules,
- Accessible and inclusive, caters to a broader demographic of learners. Continuous learning essential in the dynamic field of smart manufacturing.
- Multiple pathways empowers individuals to take control of their learning journey, thus fostering a culture of lifelong learning / professional growth



(II.b) Upskilling of incumbents, including those on 24x7 shifts



II.b

Upskill

Incumbents

II.a

Flexibility for Traditional & PTECH

Asynchronous

(II.c) Re-skill underemployed baccalaureate and transition them to technical career without interrupting income

Underemployed 50% of baccalaureates currently in the workforce can be re-skilled for Smart Manufacturing

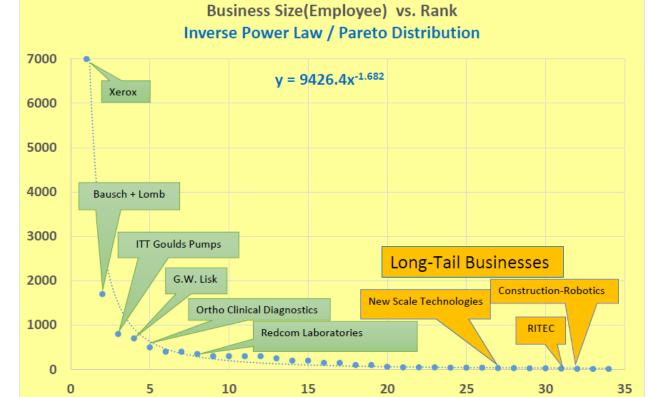
Smart Systems HyFlex Workforce for #HighTechEcosystems

Co-op Rationale

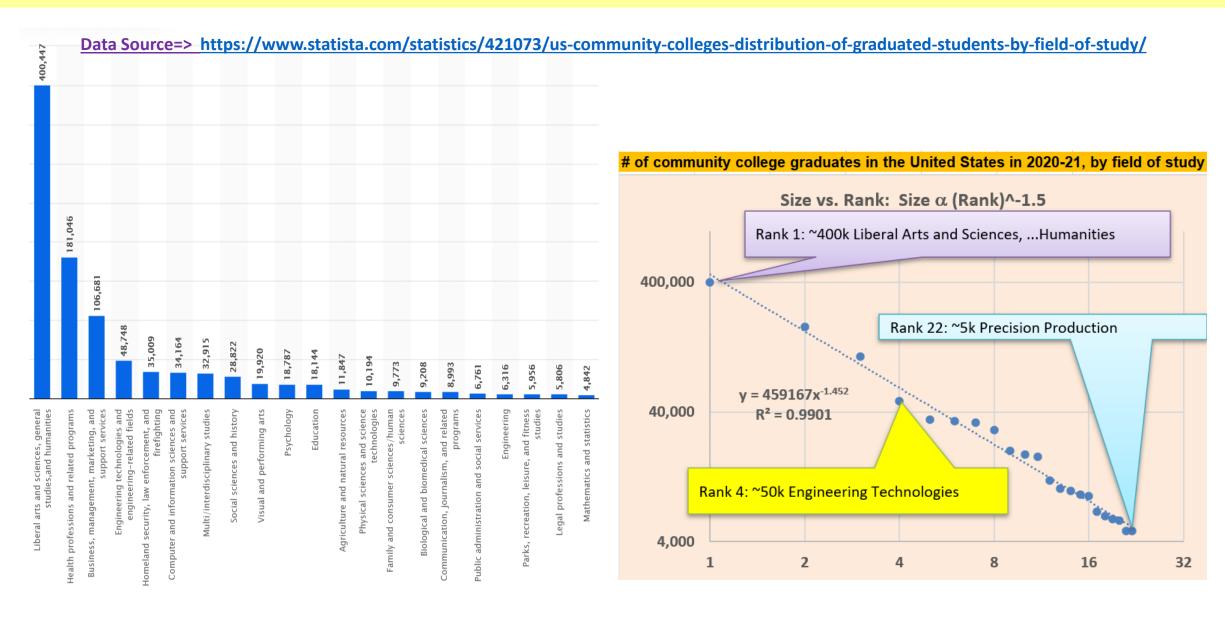
#HighTechEcosystem

Align with Self-organizing nature of geophysical, biosphere, and socioeconomic systems

- SMEs, 98% of employers, can't afford to hire a team of half dozen baccalaureates with diverse majors with different knowledge, skills and abilities (KSA) to solve challenges of implementing SM techniques
- SMEs typically hire one technical employee at a time but have difficulties finding a candidate with set of KSA specific to the business – they are looking for a "unicorn."
- Working with each of 50+ businesses in regional High-Tech Ecosystem, we match a <u>SST</u> student who may bring 6 out of 9 required KSA at the business.



Self-organizing Ecosystem (Inverse Power Law Statistics) of Community College Graduates



Required Cooperative Education (III)

.. for AAS Degree in Smart Systems Technologies at FLCC

Minimum of 270 hours

Individual student's KSAs are **matched with specific SME's needs** – develops "**Unicorns**," (individuals with unique skill sets for the SME).

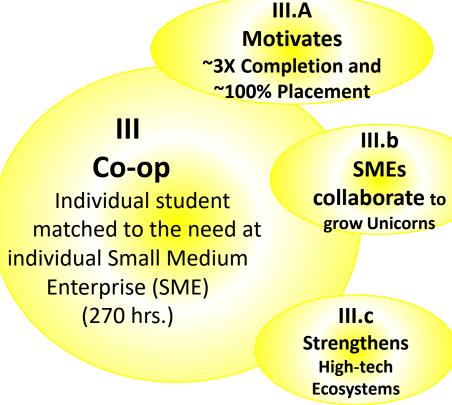
Outcomes

(III.a) Motivating completion of the program (Actively recruit "Engineering drop-outs")

(III.b) SMEs, efficiently prospect and grow "unicorns"

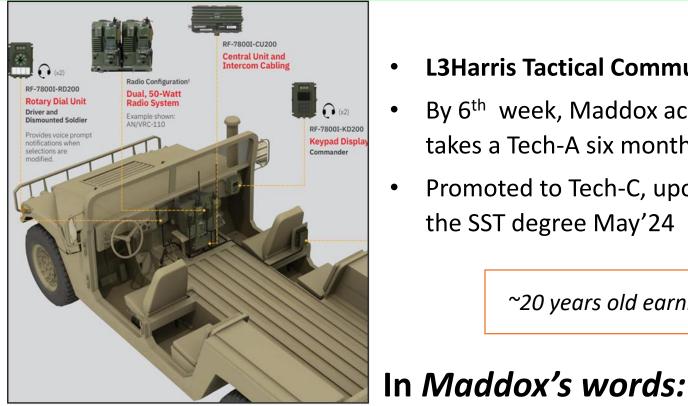
(III.c) Adaptable framework for sustainable workforce development for the #HighTechEcosystems across the nation.

Underemployed 50% of baccalaureates currently in the workforce can be re-skilled for Smart Manufacturing



III.1 Maddox Fooks at L3Harris

Joined SST program after a year in retail after high school.





L3Harris Tactical Communication

- By 6th week, Maddox acquired KSA, that takes a Tech-A six months
- Promoted to Tech-C, upon completion of the SST degree May'24

~20 years old earning over \$70k



"...real-world work experience at the age of 19, which isn't something that a lot of people my age can say. The fact that it has led to a full-time job with L3Harris is even better. "

III.2 Cody Freeman at Optipro Systems

PTECH/SST Student, completed AAS SST degree before high school diploma.



- Optipro Systems is the leading innovator of grinding, polishing, and metrology machines
- Prior use of OmronTM cobot at SST Lab
- Weeks after completing SST degree, Cody graduated from <u>PTECH</u> high school – continued working as an automation engineer.



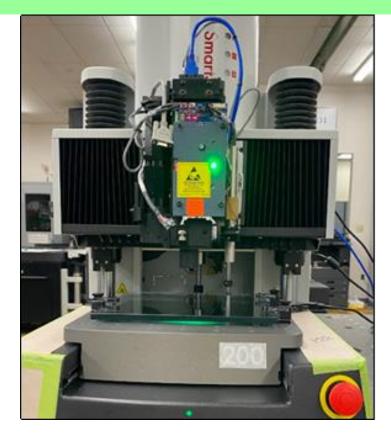


In Cody's words:

"....work experience as an automation engineer will open plenty of opportunities for the future....the SST program provided this co-op. Without that guidance, I may not have had the confidence to become an Automation engineer."

III.3 Andrew Gellatly at Quality Vision International

Completed SST program in a year after completing 24 dual credits in high school





- QVI is a world leader in optical, mechanical, electronic, and software technologies for vision and multi-sensor measurements
- Andrew built precision optical metrology machines (including mechanical assembly, computer control and testing)



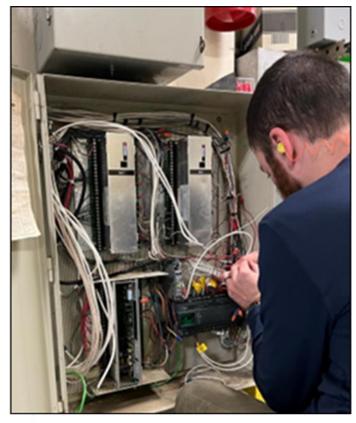
Started paid co-op on the first day of classes

In Andrew's words:

"Requiring a 270-hour Co-Op for the SST program, is the best part of the program ...also beneficial for companies looking for new employees especially those with a lot of senior employees looking to retire."

III.4 Dave Leven at Stark Tech

Underemployed Baccalaureate transitioned to High Tech career w/o break in income thanks to HyFlex Scheduling





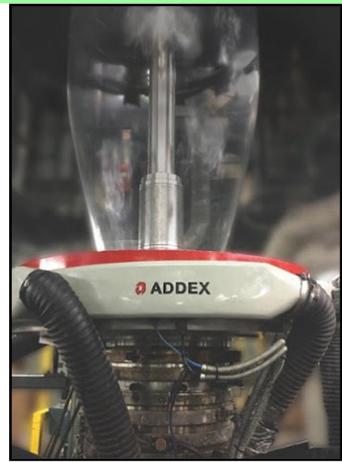
- Stark Tech focuses on **energy** efficiency, sustainability, and decarbonization using real-time data analysis & predictive analytics across commercial and institutional systems.
- **Underemployed baccalaureate** (Political Sci. UoR) Dave worked in service industry for a decade
- Continued in the service industry until • starting full-time work at Stark during the first SST semester.

In Dave's Words:

"...as a controls contractor for the installation and controlling of a heat exchanger .. to "recover" previously generated heat from the air that is being exhausted from the building. ... magnum opus of what I have learned in just about every class I have taken at FLCC

III.5 Garett Lester at <u>Addex, inc</u>.

17 years old PTECH/SST Student completed AAS SST degree before high school diploma.





- High-Performance Blown Film Cooling Equipment using real-time monitoring and thickness control of the blown film
- Small business of **six employees** needed adaptable quick learner to assist in design, manufacturing and testing

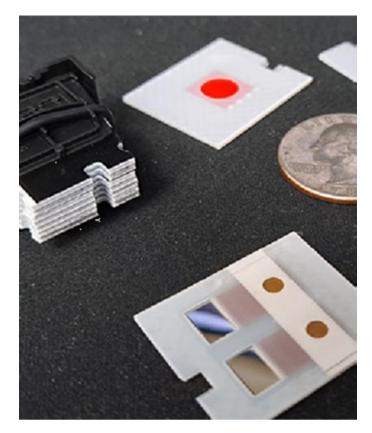


In Garett's words:

"... assembling the mechanical and electrical systems, installing programing, testing systems, performing repairs, and correcting defective products.... CO-OP has been a phenomenal learning opportunity for me."

III.6 Christopher Robinson at QuidelOrtho

Incumbent, 24x7 shift worker completed SST degree thanks to HyFlex Scheduling.





- QuidelOrtho, makes and sells 4 billion in vitro diagnostics slides used worldwide
- Chris helped model rationale for upgrading the entire vision inspection system, implement change, and track benefits of the change over.



In Chris's words:

"It was very rewarding applying all the skills learned in the SST program and seeing their relationships between areas I thought were not connected."

CO-OP Ventures XII

Smart Systems Technologies

Everyone is Welcome! May 16, 2023 4:50 pm - 6:50 pm

FLCC Victor Campus Center

200 Victor Heights Parkway, Victor NY 14564 (Conference Room VC 200)

Welcome: Dr. Robert Nye, President of Finger Lakes Community College

Guest Panel Discussion

Liberal Arts of High Technologies

Lynn Freid, Executive Director of <u>Finger Lakes Workforce Investment Board</u> David Grome, Managing Director, Business Development at <u>Greater Rochester Enterprise</u> Leah Hamilton, Workforce Development Coordinator, <u>Optimax Systems</u> Dave Leven, Integration Specialist at <u>Stark Tech</u> Ryan McCabe, Associate VP of Academic Technology & High Impact Practices at <u>FLCC</u>

Student Co-op Presentations:

Cone, Ryan	LSI Solutions	SOLUTIONS
Fooks, Maddox	L3 Herris	L3HARRIS"
Freeman, Cody	Optipro Systems	(interior)
Gellatly, Andrew	Quality Vision Intl, Redcom Laboratories	Quality Vision International Packdon for People'
Hammond, Jason	Redcom Laboratories	REDCOM
Lasecki, Ethan	Optipro Systems	<u></u>
Lester, Garett	Addex Inc.	Experience Addex
Robinson, Christopher	Ortho Clinical Diagnostics	📭 QuidelOrtho

RSVP for in-person (or WebEx) attendance: Sam.Samanta@flcc.edu

Light refreshments!

https://flcc.webex.com/meet/sam.samanta

#HyFlex Classes #PaidCoop #EarnWhileYouLearn #SustainableEducation for #ROC#FLX #HighTechEcosystem

FingerLakes

Alternate RSVP => Sam Samanta | 585-785-1105 | sam.samanta@flcc.edu | victor@flcc.edu | @DrSamSamanta |

www.flcc.edu/SST

Annual Public Event

Liberal Arts of

High Tech

Liberal arts have been essential for human adaptability to the revolutionary changes in technologies. The liberal arts habits of mind have proven critical in accelerating the pace of innovations, especially as we enter the dawn of the age of multimodal Artificial Intelligence, such as GPT4. Historians remind us of the triumphant record of humans quickly adapting to world changing innovations. Creatives confidently transfer ideas across domains of knowledge; and celebrate the mindset of life-long learners. Liberal arts foster the universality of human experiences – that search for unity amongst diversity – which helps technical world modularize myriad of items and systems, for framing, designing, manufacturing holistic systems customized and optimized for specific uses.

"Liberal Arts of High Technologies" Guest Panel Members Lynn Freid, Executive Director of <u>Finger Lakes Workforce Investment Board</u>

After Liberal Arts degree at FLCC, Lynn earned baccalaureate in Organizational Management from Keuka College. Lynn was Manager of Business Development and Training at FLCC till January 2013, and then Director of Workforce Development till end of 2015. Lynn was the Regional Director, Rochester, Finger Lakes, Genesee Valley region of the statewide Workforce Development Institute (WDI) for five years before taking on the current role in January 2021. Lynn partners with local businesses, workforce agencies and education to deliver workforce training and solutions, focusing on positive economic impact for the region.

David Grome, Managing Director, Business Development at Greater Rochester Enterprise

After earning baccalaureate degree in Political Science and Public Policy in 2007, David worked as Business Strategist at Mower Agency through end of 2013, and then for six years at Butler/Til. David has been at Greater Rochester Enterprise for over three years in his current role as in Regional Economic Development. David's expertise spans brand strategy, advertising, media, and public relations. David fosters collaboration to secure investment and drive growth in one of the world's most innovative economies, our nine-county region.

Leah Hamilton, Manager, Culture and Organizational Effectiveness, **Optimus Systems**

Leah began her work in manufacturing as a welder at her family's business. After a baccalaureate in History from McGill University in 1996, Leah worked at University of Rochester as Collections Manager of Rare Books & Special Collections till early 2013. While serving as Executive Director of Phelps Library & STEAM Lab Makerspace from 2013 to 2019, Leah had been a Freelance Graphic Designer. Leah joined Optimax Systems as the Workforce Development Coordinator in 2019, transitioning to her current role in 2023. Leah earned her Master of Art degree in Industrial and Organizational Psychology from Adler University in 2023.

Dave Leven, Integration Specialist at <u>Stark Tech</u>

After earning baccalaureate in Political Science and Government in 2009, Dave worked as Delivery Driver for Bauer and Son Moving Company for two years, before working at Thielsch Engineering starting out as installer then as Marketing Specialist, and as Project Coordinator until end of 2014. Dave worked as Warehouse Specialist for about seven years – held a second job at Maximus for the last five years, ending his role as Operations Supervisor in November 2021. While holding those two jobs, Dave started studies in our SST program in Fall of 2021. Dave transitioned into full-time job as Building Automation and Controls Integration Specialist at Stark in December 2021. Our HyFlex scheduling has allowed Dave to continue working full-time while completing his studies, and raising young family.

Ryan McCabe, Associate VP of Academic Technology & High Impact Practices at <u>FLCC</u>

Ryan earned a baccalaureate in History from SUNY Potsdam in 2002, MS in Adult and Continuing Education and Teaching from Buffalo State University in 2012, Ryan worked as Online Learning Technician at SUNY Canton from 2006 to 2008, then transitioned to Finger Lakes Community College holding the roles of instructional Designer, Asststant Director of Online Learning and Director of Online Learning until 2019 and has been in his current role since then. Ryan organized training on the HyFlex learning framework, grew the college's online degree offerings from 12 to 23 fully online programs or certificates, aligned the Certified Production Technician training with parts of the SST curriculum, and recently led a professional development day session on "Leading with Empathy." Ryan also teaches in the Computer Science department in an adjunct role.

Smart Systems HyFlex Workforce for #HighTechEcosystems

#	Co-op/lob Opportunities #SustainableEducation #EarnWhileYouLearn
	Advanced Atomization Technologies Clyde (A Parker Aerospace and GE Aerospace Joint Venture)
	ABX Innovative Pedaging Solutions Macedon (Plastic Films and Packaging) Addex Inc. Newark (Global Supplier of High-Performance Blown Film Cooling Equipment)
4	Applied Image Inc. Rochester (Optophotonics Systems and Image Analysis) Akoustis Technologies Canandaigua (Bulk Wave Filters for Cellphone RF Interface)
2	Beldwin Richardson Foods Co. Macedon (Automated Bottling and Canning)
	Bausch + Lomb Rochester (Ophthalmological Personal Products) Bosch Security Systems, Inc. Fairport (Survejllance, Access Control, Intrusion and Fire Detection)
	Bristol Instruments Victor (Extreme Predsion Optical Metrology)
	Construction-Robotics Victor (Robotic Masonry)
	Creation Technologies Newark (Electronic Systems)
	Dynalec Corp. Sodus (Shipboard electrical, electronics, and control systems for the U.S. Navy)
	Eastman Kodak Rochester (Instrumentation and Control, e.g. Solvent Recovery Process)
	Exelia Micropen Technologies Honeoye Falls (Medical Technology)
	Finger Lakes Community College Canandaigua (Building Maintenance & Climate Control System)
	Keurig Dr Pepper Williamson (Automated Bottling and Packaging)
	Gallo Winery Canada(gua (Winery Process Automation Control)
	GE Vernove Rochester (Innovations for Future of Smart Energy Systems)
	Ginna Nuclear Power Plant Ontario (Instrumentation)
	Gleason Automation System Rochester (Automated Loading/Unloading Systems)
	Gorbal Victor (Automation/Controls Industrial Cranes, Smart Hoists, Medical Harness)
	G.W. Liek Clifton Springs (Precision Solenoids, LVDTs)
	Han-tak Honeoye Falls (Custom Automated Solutions: Design, Fabrication, Installation, Training)
	Harbee Ontario (Sustainability integrated Prototyping, Tooling, Machining and Manufacturing)
	IdeaBoxx Victor (Products for medical and food service industry)
26	Industrial Industing Systems Victor (Automation and Control Systems)
27	ITT Goulde Pumpe Inc, Seneca Falls (Industrial Fluidics)
28	L3Harrie RF Henrietta (Tactical Communication Radio & Network)
29	LSI Solutions Victor (Medical Technology: Laparoscopic Devices)
	MiniTec Framing Systems Farmington (Modular Aluminum Framing for Construction)
	Motion Al Rochester (Oustom Solutions to the Automation and Motion Control)
	Monsees Group Rochester (Precision Mfg for Optics/Photonics, Aerospace)
	New Scale Technologies Victor (Piezo Micromotors, Automated Gauging using Cobots)
	Novomer/Denimer Rochester (Automation for High Performance, Carbon Efficient Polymers)
	Optimation Technology Inc, Rush (Industrial Automation)
	Optimax Systems Ontario (Predsion Custom Optics)
	Optipro Systems Ontario (Optics Machining Machines)
	Ormac Systems Rochester (Precision Motion Control: Aerospace & Military Solutions)
	PactivEvergreen Canandaigua (Fresh food and Beverage Packaging Powerhouse)
	PALIOT Solutions, Shortsville (Smart Pallet Hyperconnecting the Global Supply Chain) PEKO Precision Rochester (Technology Development and Product Commercialization)
	Progressive Machine Design Victor (Machine Automation Systems)
	Quality Vision International, RAM Rochester (Optical Metrology Instrumentation)
	QuidelOrtho Rochester (Automated Manufacturing for In Vitro Diagnostics)
	Railcomm Fairport (Networked Controls for Railroads)
	Redcom Laboratories Victor (RF Communication Systems and EMS)
	RITEC Henrietta (Networked Sensors and Process Control)
	Rochester Silver Works Rochester (Silver Refining & PET/CTA Recycling)
	Safran Federal Systems Rochester (Precise Devices for Position, Navigation & Timing)
	Stark Tech Rochester (Intelligent Building Solutions for Total Facilities Optimization)
	Surmotech Victor (Electronic Assembly and System Integration)
	Transcat Rochester (Calibration, Test and Measurement Instruments)
	Ultrafab Farmington (Engineered Weather Stripping Products)
	Vertex Optics Victor (Precision Optics and Ceramics Components)
	Viewpoint Systems Henrjetta (Automated Test Systems for Industries)
	Water Treatment, City of Rochester Hemlock (Instrumentation Control)
	Xerox Corp. Webster (Document Mechatronics, Informatics)

Smart Systems HyFlex Workforce for #HighTechEcosystems

50+ Businesses across #HighTechEcosystem

Annual Public Event

CO-OP Ventures XIII

Smart Systems Technologies

Everyone is Welcome! May 14, 2024 4:50 pm - 6:50 pm

FLCC Victor Campus Center Welcome: Dr. Robert Nye, <u>President of Finger Lakes Community College</u>

Student Co-op/Job Presentations:

Bishop, Nolen Burchett, Dylan Ceine, Thomas Fooks, Meddox Gellatly, Andrew Laity, Brendan Ingrassia, Anthony Collins, Samuel Parulski, Gabriel Primrose, Nate Tipton, Elle

Optipro Systems Optipro Systems Optipro Systems L3Harris New Scale Technologies Abtex Island Components Group (4 W Lisk) Dynalec Corporation Finger Lakes CC (Building Maint, & Ctrl.) Creation Technologies Creation Technologies



#HyFlex allows #EarnWhileYouLearn #PaidCoop #FullTimeWork #IncumbentWorkers #UnderEmployedBaccalaureates #SustainableEducation for #ROC #FLX #HighTechEcosystem



Alternate RSVP => Sam Samanta | 585-785-1105 | sam.samanta@flcc.edu | victor@flcc.edu 🛅 DrSamSamanta |

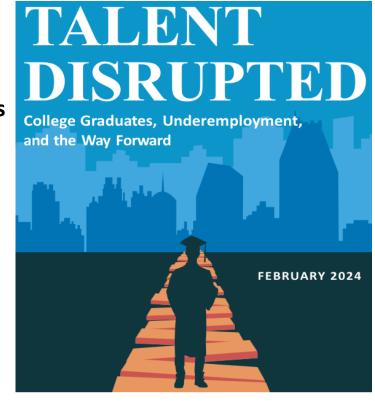
www.flcc.edu/SST



III Co-op Summary

Co-op Case Studies of Growing Smart Manufacturing Workforce at SMEs

- Six case studies of recent SST co-ops represent over 100 co-ops placed by of <u>www.flcc.edu/SST</u> over past decade – SMEs grow "unicorns" efficiently.
- Address Smart Manufacturing workforce needs at SMEs in high-tech ecosystems across the region and nation.
- Due to incentive of paid co-op and HyFlex scheduling completion rate 2.5x higher than national rate for technical programs, and
 (1) Co-ops can start full-time job, while completing studies
 (2) Incumbent workers have opportunity to complete SST degree,
 (3) Underemployed baccalaureates transitioned into high-tech, without loss of income.
- According to "<u>Talent Disrupted</u>" 52% of recent baccalaureates are underemployed.
- Hidden national resource for national workforce imperatives of ManufacturingUSA, CHIPS, and resilient supply chains – the challenge is to find ways, such as ours, to reskill them without break in income.



6ürningglass



<u>Sam.Samanta@flcc.edu</u>

Conclusions & Implications

Smart Systems HyFlex Workforce for #HighTechEcosystems

Bootstrap Smart Technologies + HyFlex => Broadened Access

for conventional students, PTECH, Incumbent workers, Remote students, Underemployed baccalaureates

MUST Require Paid Co-ops =>

High rates of completion (75 %) & Job placement (~100 %)

Efficient blueprint for Sustainably meeting Workforce

- Needs of 98 percent of high-tech employers
- Ramp-up challenge for advanced manufacturing technologies accelerated by the Manufacturing USA Institutes and reshoring initiatives of the CHIPS Act.

Reskill 0.5% of 20 Million underemployed baccalaureates per year *Hidden national resource for Advance Manufacturing Workforce.*



Cumulative Economic Impact (CEI): \$100M over a decade, 10 SST grads/yr. Scaling up 10,000/yr (10 grads/cc) to 100,000/yr (100 grads/cc) across nation, will generate CEI of \$100 Billion to \$1 Trillion over a decade and *improve lives of 100,000 to 1 million families*.

The STEM Labor Market and the Economy

https://ncses.nsf.gov/indicators

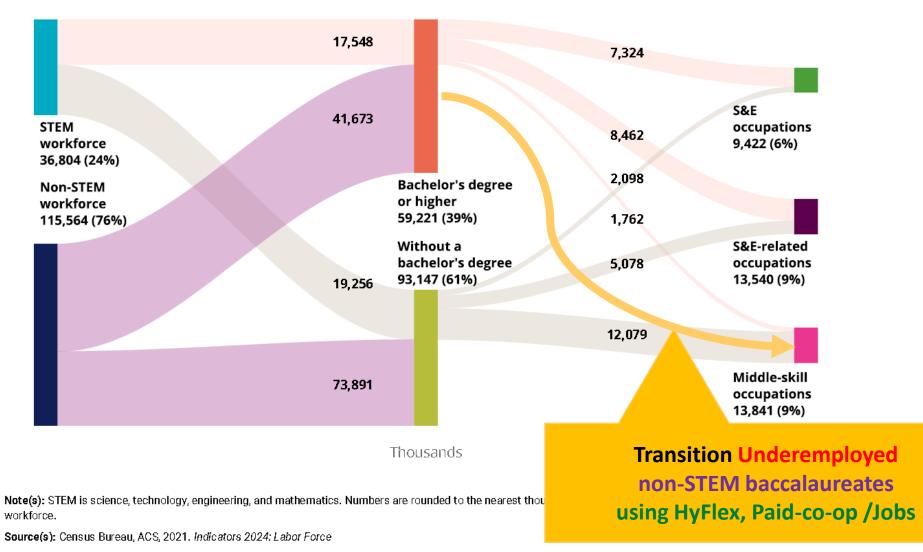
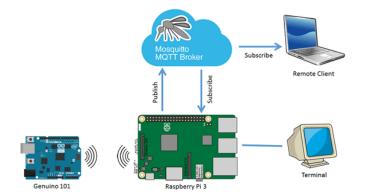


Figure 7. U.S. workforce, by STEM occupation group and education level: 2021

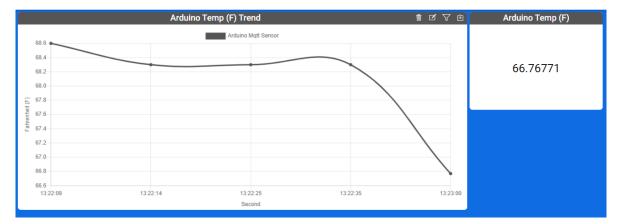
Smart Systems HyFlex Workforce for #HighTechEcosystems

Extending SMLS Capability Arduino Wi-Fi R4 Integration with Mosquitto Broker (continued)

Able to use Arduino R4 WiFi and sensor to publish to MQTT Broker running on SMLS and publish data to the Web Browser



Arduino MQTT



Sparkplug payload structure embedded in Arduino code. Simply change the *name* for different Arduino sensors. The structure is as follows:

```
{
    "timestamp": 1629384629,
    "metrics": [
        {
            "name": "arduino_sensor/temp1_f",
            "timestamp": 1629384629,
            "data_type": "float",
            "value": 72.5
        }
    ],
    "seq": 1
}
```

Standalone Arduino Wi-Fi R4 Integrated with MQTT Broker

Resource for Remote Students



 Using a Raspberry Pi (with option Argon expansion case) as both a SoftAP and a MQTT Broker, the data from the Arduino can be published on a web browser for end-user interface purposes. Projects can be expanded to include proximity/position sensing, bar code readers, light sensing, etc.

Available option for Web-Based Sensor Data Display

SoftAP: SW enabled Access Point

Smart Systems HyFlex Workforce for #HighTechEcosystems

<u>Sam.Samanta@flcc.edu</u>