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MUBER: NEW APPROACH FOR OPERATOR ASSIGNMENT IN A SMART FACTORY

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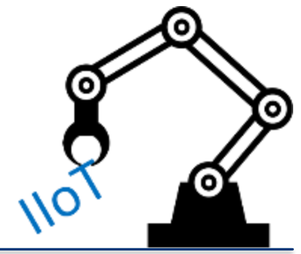

INDUSTRY NEED & RELEVANCE…

WHAT DOES UBER HAVE TO DO WITH THE MANUFACTURE OF AIRCRAFT ENGINES?

Fusing Next-Generation Information Technology and Manufacturing Technology in a Networked Smart Factory Environment to Achieve Efficient Low-Volume Manufacturing

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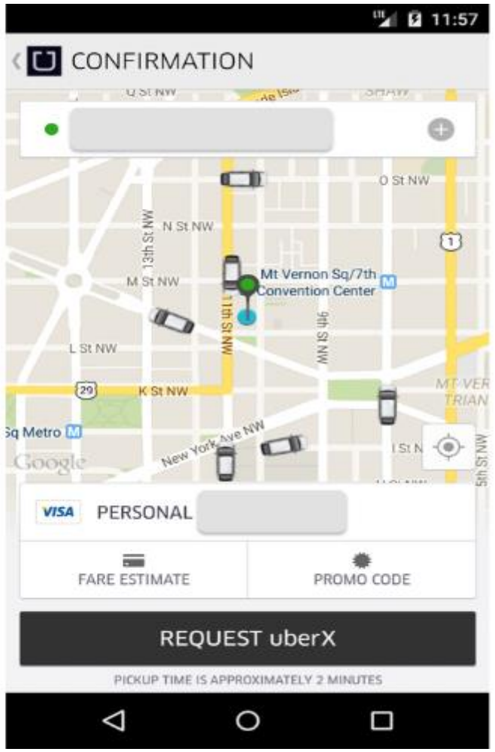
QUITE A LOT, ACTUALLY…



THE M-UBER APPROACH

- Every operator uses app for machine assignments.
- Can accept or reject assignment
- Indicates machine, intervention type, time estimate.
- Operator location is tracked.
- Operator productivity is monitored.

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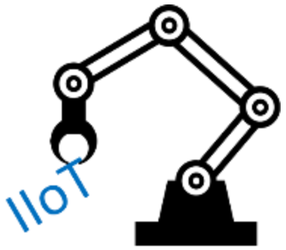
PROJECT OBJECTIVE…



ENABLING IIOT TECHNOLOGIES

- **IIoT** connects operators and machines for sharing information in real-time.
- **MOBILE WIRELESS APPLICATION** connects operators and machines "anywhere, anytime" and provides visibility across shop floor.
- **BIG DATA ANALYTICS** machine learning, AI, etc. anticipate machine or other failures and down time.
- **INTELLIGENT ASSIGNMENT TOOL** matches operator skills with intervention requirements. Machine sensors report operational status of machines.

- Reduced number of operators
- Reduced machine down time
- Reduced operator idle time
- Increased number of parts completed

TO LEVERAGE IIoT CAPABILITIES ON THE FACTORY FLOOR TO IMPROVE PRODUCTIVITY

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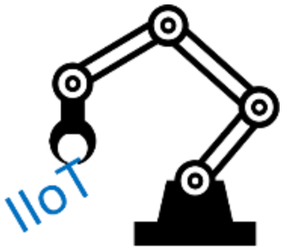
APPROACH & METHODOLOGY…



Simulation of Fixed Operator Assignment versus M-Uber Operator Assignment:

- Fixed Assignment (c.f. Traditional): One operator assigned to two machines
- Machining-Uber Assignment (c.f. M-Uber): No operator is assigned to a particular machine. Intelligent assignment engine makes assignment based on nearest available, best skill set, etc.

Evaluate M-Uber Advantages: Reduced number of operators, improved responsiveness to machine stoppages (maximize uptime), and increase in production quantities.

Analyze Digital Thread: By continually monitoring machine status, it will serve as a "big data" resource that will improve performance, e.g., preventative maintenance and enterprise-wide workflow balancing.

A "fixed" operator assignment policy is converted to a "floating" operator concept.

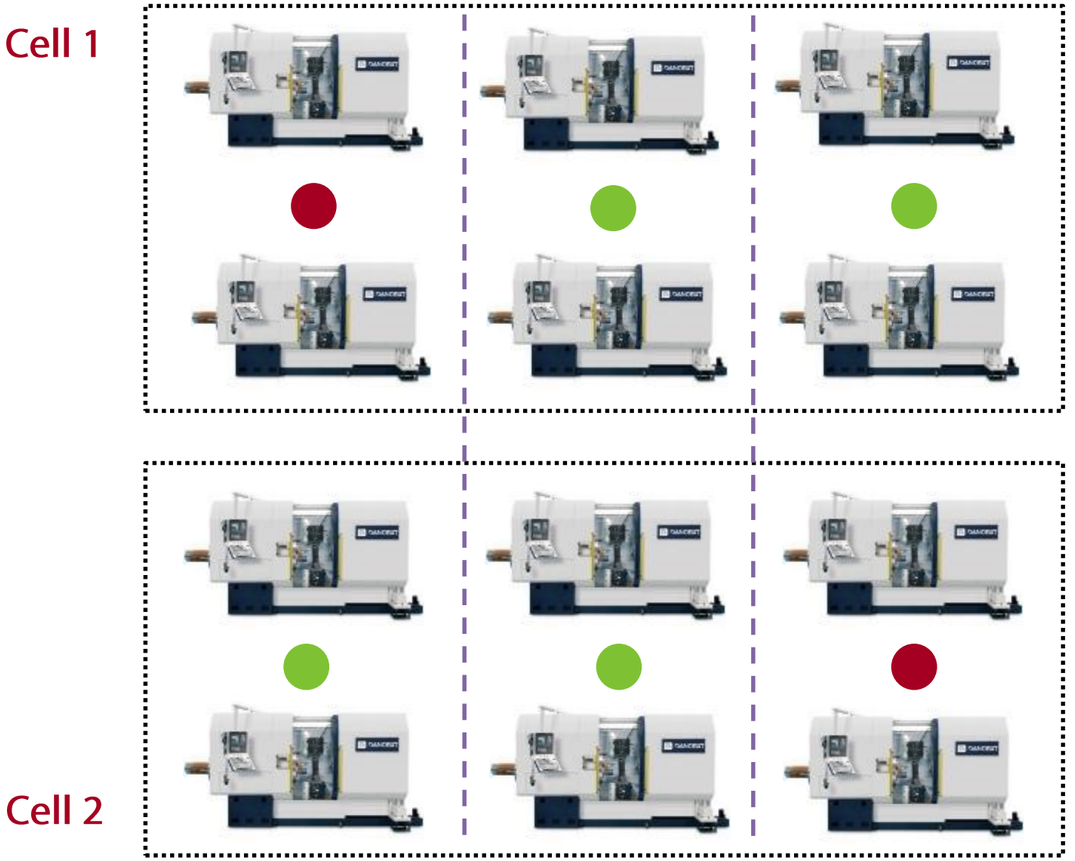
ONE DAY IN THE LIFE OF A TRADITIONAL FACTORY …

In **fixed assignment** operations, one operator is assigned to two (or perhaps three) machines in a cell.

The operator is responsible for serving **only** those machines.

Challenges

- both machines require intervention *(lost productive machine time)*
- neither machine requires intervention *(underutilized operator time)*



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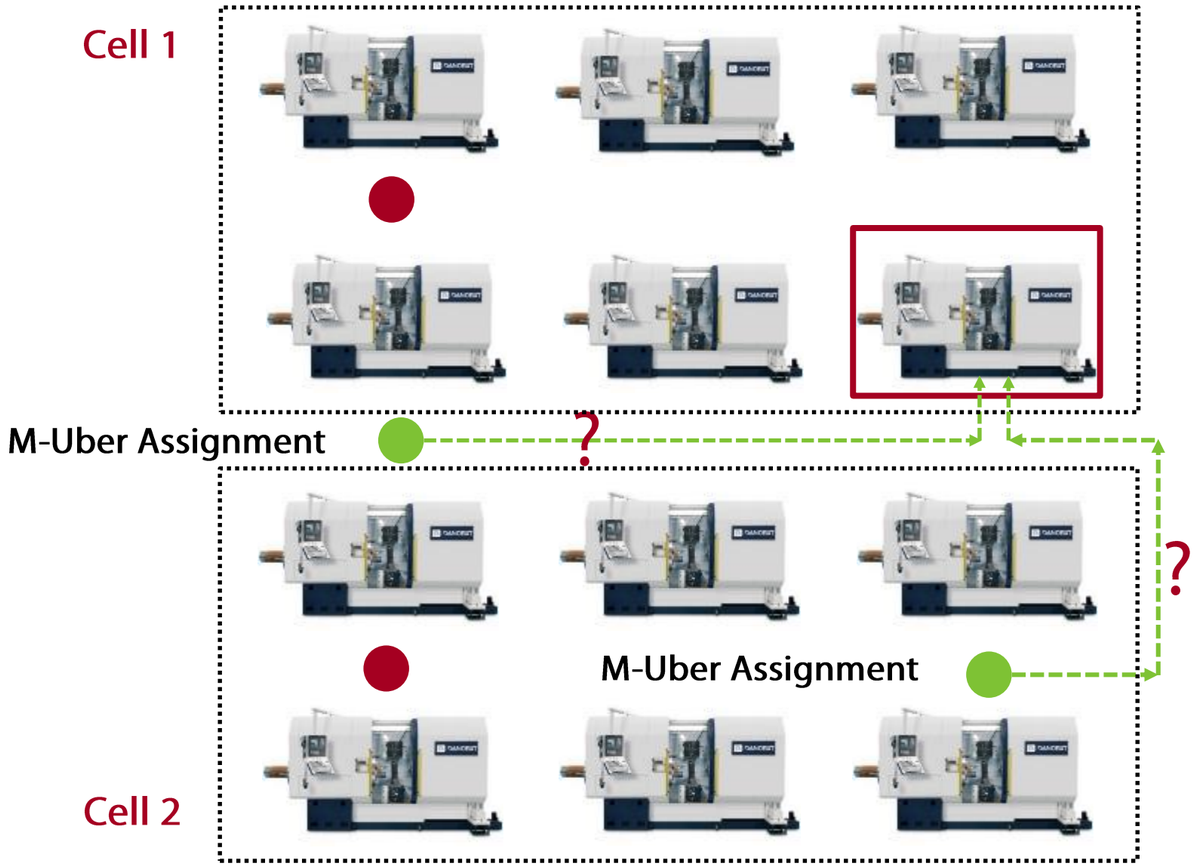
ONE DAY IN THE LIFE OF AN M-UBER FACTORY …

In **M-Uber assignment**, a collection of operators service all machines, where no operator is assigned to a particular machine or group of machines ….***floating assignment.***



Advantages

- Optimize number of operators
- Improved operator responsiveness (proximity, skill set, anticipation)
- Increased productivity

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M-Uber

Run Simulation

About

Exit

TOOL CHANGE	ANTICIPATED MAINTENANCE	UNSCHEDULED MAINTENANCE	PART COMPLETE NEW SET-UP
			

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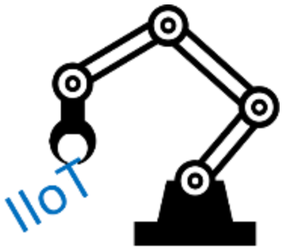
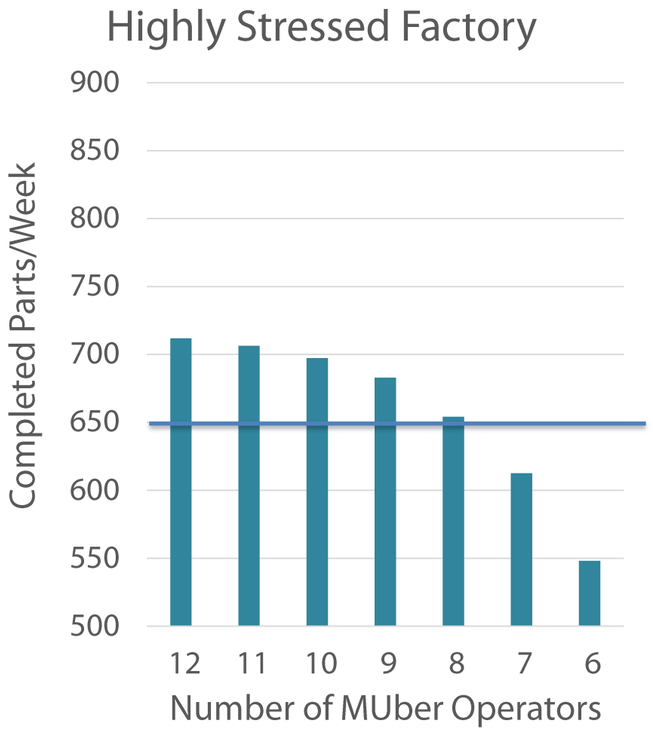
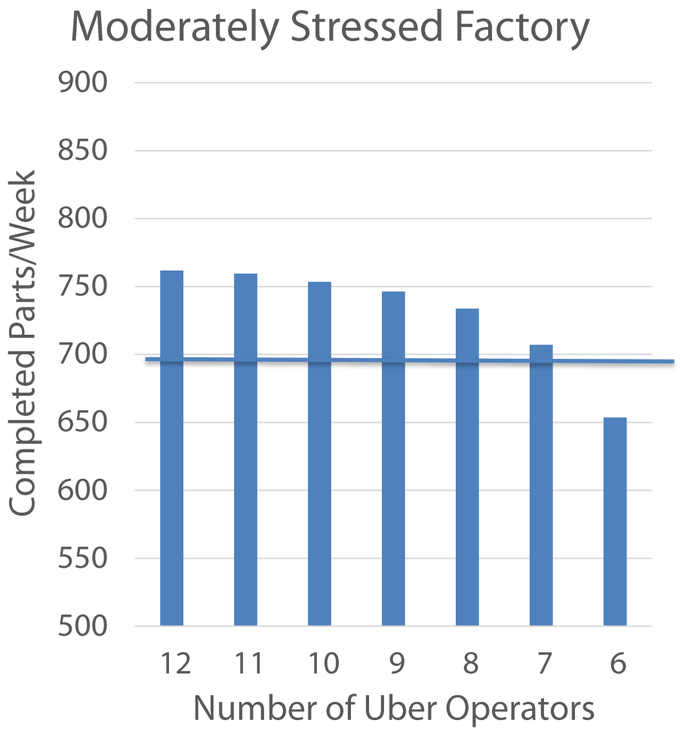
RESULTS…

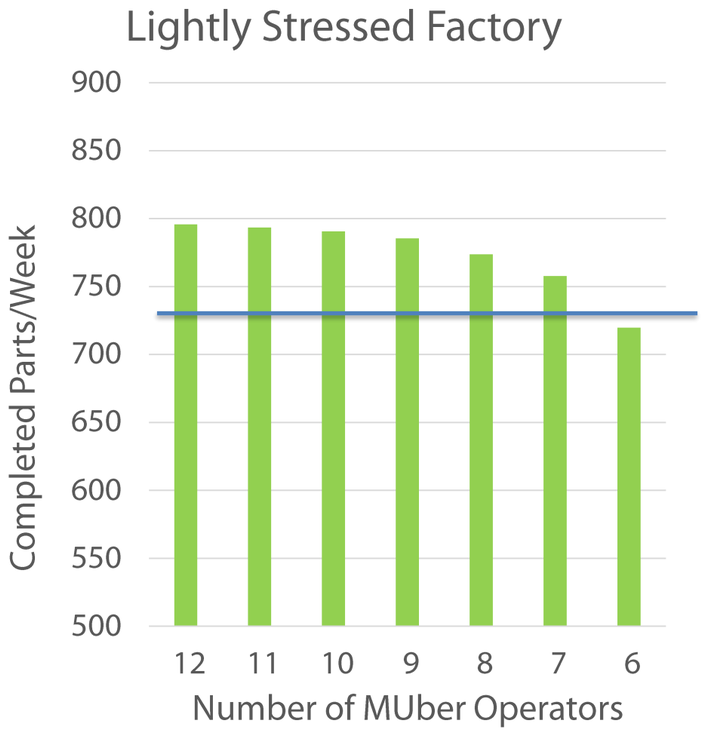
Improved performance with M-Uber over Fixed Assignment for > 8 workers.

Better performance with M-Uber for Less Stressed Factories









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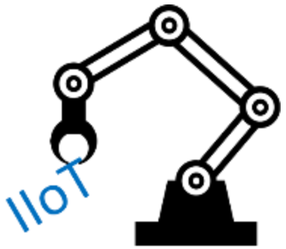
NEXT STEPS…



- Evaluate different policies for assigning operators to machines to optimized performance.
- Improve intelligent assignment tool to incorporate different worker skill levels.
- Evaluate M-Uber in different manufacturing environments (other cell configurations, sequential lines, etc.)
- Integrate robotics into M-Uber factory floor environment.
- Evaluate "digital thread" for continuous improvement.
- Implement "learning" of factory floor dynamics.