PROJECT PROPORSAL

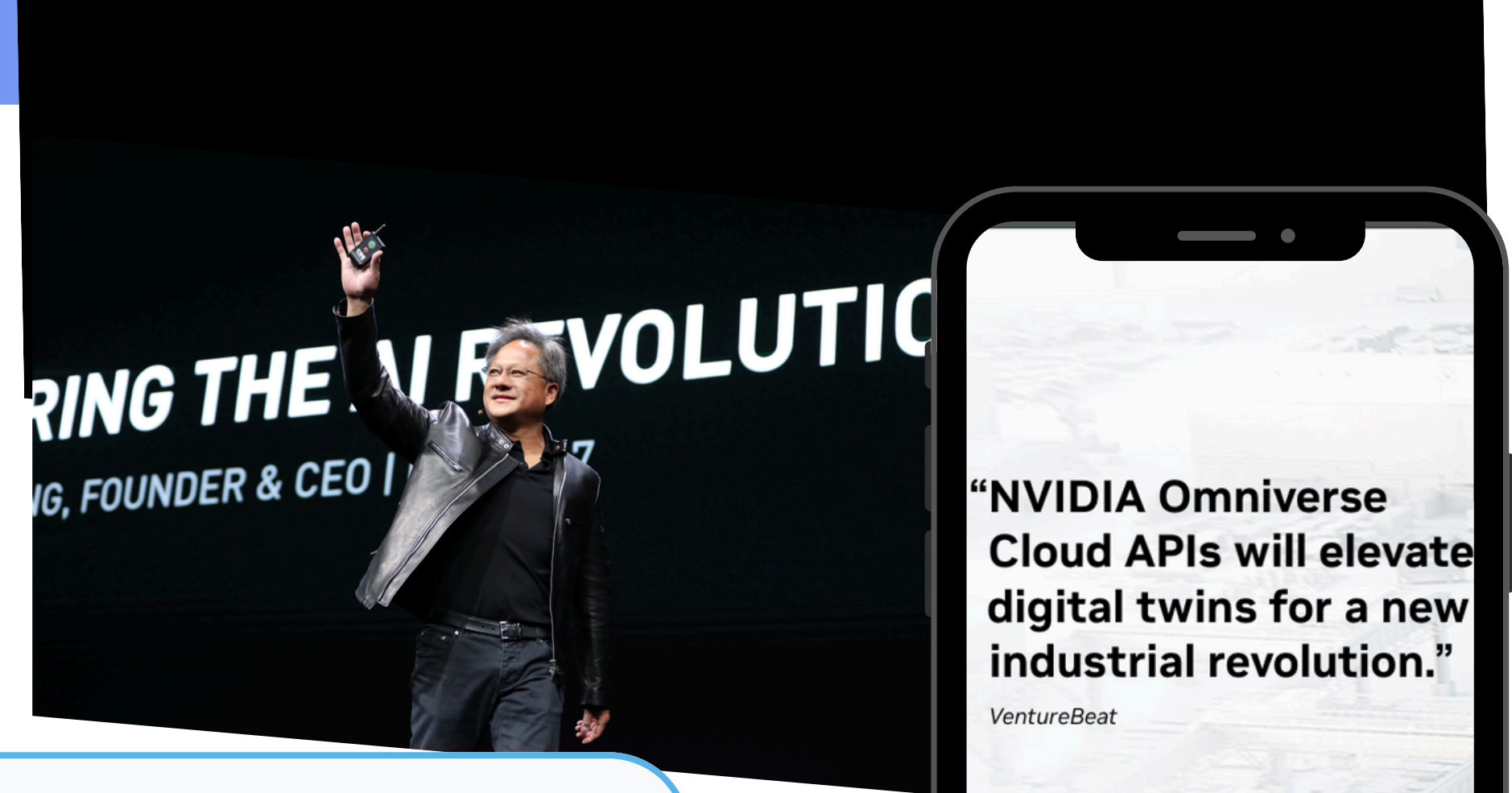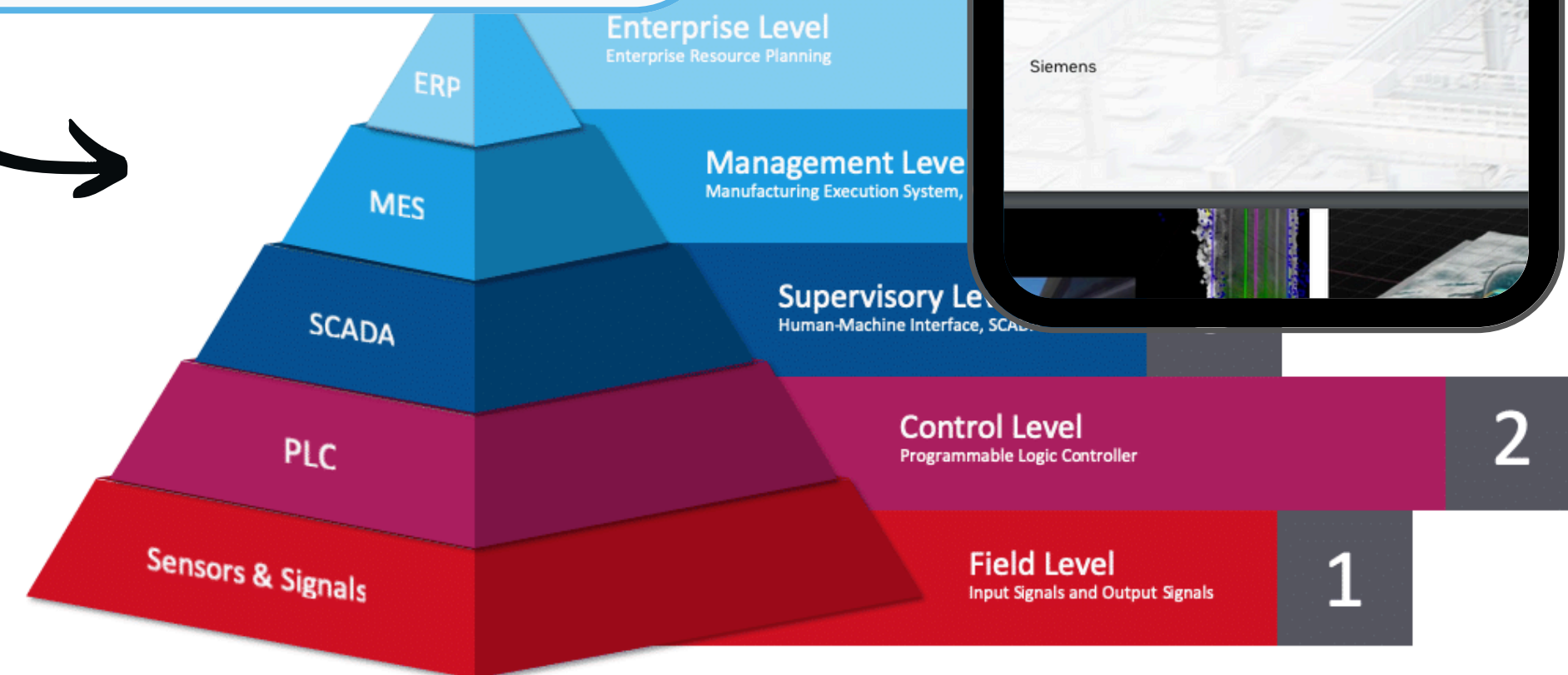**IRENA ZIMOVSKA & POLA PAROL**

THE ERA OF INDUSTRIAL METAVERSE

In 2022, NVIDIA partnered with Siemens Xcelerator to build digital twins in Omniverse Cloud. In March 2024 NVIDIA released the Blackwell chip, that will definitely accelerate the pace of Industry 4.0's transformation of global manufacturing.

Enterprises are increasingly integrating Enterprise Resource Planning **(ERP)**, Manufacturing Execution Systems **(MES)**, and Supervisory Control and Data Acquisition **(SCADA)** systems to streamline operations and improve decision-making.

Digital twins, providing virtual replicas of physical assets and processes, are gaining momentum for their ability to offer real-time insights and optimize production workflows.

However, as data science students, we firmly believe that Industry 4.0 starts with incremental steps and data-driven insights at the low level - primarily, by getting first data on enterprise productivity.

"NVIDIA Omniverse Cloud APIs will elevate digital twins for a new industrial revolution."
VentureBeat

NVIDIA Omniverse Cloud will be available as APIs, extending the reach of the world's leading platform for creating industrial digital twin applications and workflows across the entire ecosystem of software makers.

Siemens

EVERY MANUFACTURER WANTS ERP, MES, SCADA.
BECAUSE WE WANT TO BE INDUSTRY 4.0

Enterprise Level
Enterprise Resource Planning
ERP

Management Level
Manufacturing Execution System,
MES

Supervisory Level
Human-Machine Interface, SCADA
SCADA

Control Level
Programmable Logic Controller
PLC

2

Field Level
Input Signals and Output Signals
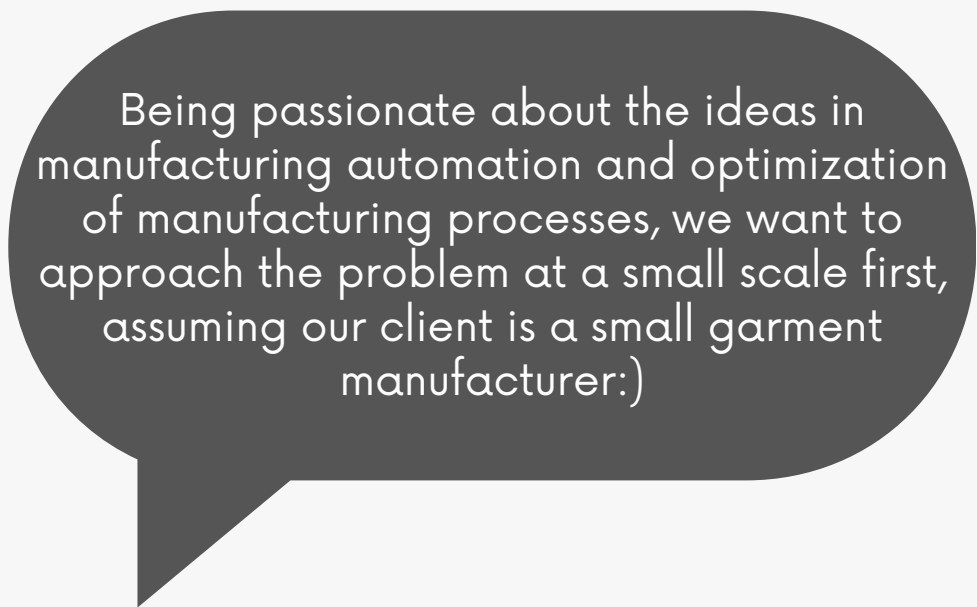Sensors & Signals

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THE BUSINESS SCENARIO

problem description

The garment industry is facing a pressing challenge of low productivity, particularly evident in companies like "X." Despite a surge in product demand, maintaining sufficient levels of employee productivity during the production process has proven difficult. Analyzing data pertaining to production processes and productivity-influencing factors is crucial in identifying bottlenecks and inefficiencies that hinder optimal performance.

company need

Company X recognizes the need of cost optimization & enhancing productivity to meet escalating market demands and sustain competitiveness. Our potential client requires actionable insights derived from data analysis to devise effective strategies for human resource management and manufacturing process optimization. By leveraging these insights, "X" aims to streamline operations, boost employee productivity, and efficiently meet the growing needs of the market while staying ahead of competitors. Better understanding of employee productiveness will allow the client to manage and plan orders.

Being passionate about the ideas in manufacturing automation and optimization of manufacturing processes, we want to approach the problem at a small scale first, assuming our client is a small garment manufacturer:)
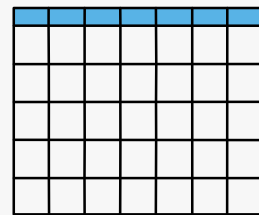
DISCLAIMER

DATASET DESCRIPTION
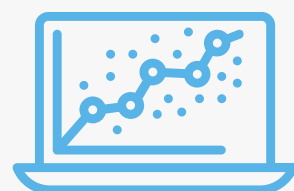
Source

kaggle dataset link

Size

15 columns x 1197 records

Problem

Analyze staff productivity for further prediction

Features

It includes information such as date, day of the week, quarter, department, team number, number of workers in the team...

DATASET DESCRIPTION

date: Date in MM-DD-YYYY format.

day: Day of the week.

quarter: Segment of the month divided into four quarters.

department: Relevant department associated with the instance.

team_no: Specific team number associated with the instance.

no_of_workers: Quantity of workers in each team.

no_of_style_change: Number of style alterations for a specific product.

targeted_productivity: Planned productivity established by the authority for each team per day.

smv: Standard Minute Value, indicating the allocated time for a task.

wip: Work in progress, encompassing the quantity of unfinished items for products.

over_time: Reflects the overtime duration by each team, measured in minutes.

incentive: Represents the monetary incentive (in BDT) intended to encourage specific actions.

idle_time: Duration of time when production was interrupted due to various reasons.

idle_men: Number of workers rendered idle due to production interruptions.

actual_productivity: The actual percentage of productivity achieved by workers, ranging from 0 to 1.

data info

```
 #   Column                 Non-Null Count   Dtype
---  ------                 --------------   -----
 0   date                   1197 non-null    object
 1   quarter                1197 non-null    object
 2   department             1197 non-null    object
 3   day                    1197 non-null    object
 4   team                   1197 non-null    int64
 5   targeted_productivity  1197 non-null    float64
 6   smv                    1197 non-null    float64
 7   wip                    691 non-null     float64
 8   over_time              1197 non-null    int64
 9   incentive              1197 non-null    int64
 10  idle_time              1197 non-null    float64
 11  idle_men               1197 non-null    int64
 12  no_of_style_change     1197 non-null    int64
 13  no_of_workers          1197 non-null    float64
 14  actual_productivity    1197 non-null    float64
```

	date	quarter	department	day	team	targeted_productivity	smv	wip	over_time	incentive	idle_time	idle_men	no_of_style_change	no_of_workers	actual_productivity
553	2/1/2015	Quarter1	sweing	Sunday	9	0.75	29.12	1282.0	6960	45	0.0	0	0	58.0	0.750593
516	1/29/2015	Quarter5	finishing	Thursday	3	0.80	3.94	NaN	960	0	0.0	0	0	8.0	0.492500
604	2/4/2015	Quarter1	finishing	Wednesday	8	0.70	4.15	NaN	3000	0	0.0	0	0	25.0	0.915767
328	1/19/2015	Quarter3	sweing	Monday	10	0.70	22.52	938.0	10080	63	0.0	0	0	56.0	0.750057
1018	3/2/2015	Quarter1	sweing	Monday	4	0.65	26.66	832.0	6780	55	0.0	0	0	57.0	0.750255
855	2/19/2015	Quarter3	sweing	Thursday	8	0.70	29.40	1116.0	6240	0	0.0	0	2	57.0	0.700000
245	1/14/2015	Quarter2	sweing	Wednesday	8	0.80	25.90	1218.0	10170	60	0.0	0	0	56.5	0.850137
415	1/24/2015	Quarter4	finishing	Saturday	9	0.60	3.94	NaN	1440	0	0.0	0	0	8.0	0.261174
1132	3/9/2015	Quarter2	sweing	Monday	1	0.75	26.82	1322.0	7140	65	0.0	0	0	59.0	0.850427
55	1/4/2015	Quarter1	sweing	Sunday	3	0.75	19.87	734.0	6600	45	0.0	0	0	55.0	0.750243

PROJECT OBJECTIVE

The idea of the endeavor is to create a PowerBI dashboard application so that a client could get a high level understanding of employee productivity. It should address the problem of reducing the loss in production due to efficiency pitfalls.

PRELIMINARY QUESTIONS

How does the targeted productivity set by authorities impact actual productivity?

How does the number of workers in a team correlate with productivity levels?

Is there a correlation between financial incentives and productivity?

Do teams with higher levels of overtime exhibit lower productivity?

What could be the reasons of production interruption?

SOURCES:

[1] https://nvidianews.nvidia.com/news/nvidia-to-host-worlds-top-ai-experts-at-gpu-technology-conference

[2] https://images.nvidia.com/nvimages/gtc/pdf/gtc24-spring-best-of-highlight.pdf?regcode=no-ncid&ncid=no-ncid

[3] https://resources.nvidia.com/en-us-omniverse-industrial-digital-twins/siemens-and-nvidia-technology?lx=deNrXD

[4] https://forcam.com/en/blog/mes-importance-and-benefits-manufacturing-execution-system/