MVP Prototype (Final Version)

Course: Business Challenge I - Data Analysis Challenge - BCH-7810 – BMBAN1

Team Assignment: Phase 3: MVP Prototyping and Testing

Due Date: December 20, 2024

Group 6:

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Model Structure

The AI Workforce & Carbon Footprint Optimization Platform is an interactive and data-driven MVP prototype designed to optimize task assignments, monitor emissions, and measure workforce efficiency. It integrates Tableau for visualization, supported by Python-based analytical insights.

Design,

The platform illustrates workforce types (Collaborative, Machine-only, Human-only) to monitor task duration, energy consumption, and carbon emissions.

A KPI segment showcases overall emissions, average task length, and energy usage, enabling users to enter target figures for comparison with real outcomes.

Components of Tableau Dashboard,

- **Performance Table:** Condenses essential metrics such as cement consumption, e missions, and energy use organized by task categories.
- **Bar Chart:** Shows distribution of tasks based on duration and categories of tasks.
- **Line Chart:** Displays task duration in relation to emissions for analyzing trends.
- **KPI Table with Insights:** Enables users to enter target values and automatically produces performance-driven recommendations.

Python Integration,

Automates the preprocessing of data, including aggregation and summarization tasks. Produces practical insights derived from user input (for instance, "Total emissions surpass the target." Concentrate on improvement.

Data Sources

Variables,

- **Task ID:** A distinct identifier assigned to every task.

- **Task Type:** Classification of tasks into Collaborative, Machine-exclusive, and Human-exclusive.

- **Cement:** Resource usage assessed for each task.

- **Emissions:** Overall carbon emissions (kg CO2) produced for each task.

- **Task Duration:** Hours (time) required to finish the task.

- **Energy Consumption:** Overall energy usage (kWh) for performing tasks.

Data Preparation,

Values that were absent in columns such as Cement and Energy Usage were addressed through mean imputation. Task lengths and emissions were compiled by task category for visual representations. KPIs like Total Emissions, Average Task Duration, and Total Energy Consumption were computed to match user inputs and offer real-time insights.

Importance to the Issue,

The information corresponds with the platform's objective of optimizing the workforce through AI and monitoring emissions. Consolidated and refined insights allow decision-makers to enhance workflows, lower emissions, and boost sustainability performance.

AI Integration:

Incorporating AI-powered analytical features into the MVP boosts its performance and decision-making abilities.

KPI-Driven Insights,

User-supplied metrics for KPIs like Total Emissions, Average Task Duration, and Energy Consumption are evaluated against real values.

The system generates actionable insights in a dynamic manner:

"Overall emissions surpass the goal." Concentrate on enhancement.

"Typical task length is less than the goal." "Great job!"

"Energy consumption is on track." "Preserve the existing performance."

Automated Analytics utilizing Python,

Python scripts prepare and examine data, providing real-time insights for KPIs. Sophisticated analytics identify improvement opportunities (e.g., elevated emissions or delays in tasks) and enhance task performance.

Machine Learning-Driven Insights,

While the current MVP does not include advanced machine-learning models, it leverages data preprocessing techniques and dynamic calculations to generate insights. Future iterations can incorporate predictive algorithms to further optimize emissions reduction and resource allocation.

Panel Representation,

Tableau dashboards incorporate AI-driven insights, enabling users to visually follow, observe, and respond to the platform's suggestions. The integration of AI greatly enhances the MVP's effectiveness by synchronizing data insights with user objectives, facilitating data-informed decision-making for sustainability and efficiency improvements.

Insights on Testing and Refinement

The ongoing testing and feedback cycle greatly improved the platform's usability, precision, and pertinence.

Dashboard Optimization,

Based on peer feedback, spacing adjustments were made to the KPI insights section to reduce visual clutter. Additionally, consistent color schemes were applied across visualizations to improve readability and category identification. These refinements enhanced usability and visual coherence, aligning the design with user-centered principles.

Preliminary Comments,

User feedback highlighted the need for simplified visualizations and streamlined metrics. The removal of the bubble scatter plot addressed concerns about redundancy with the line chart. The inclusion of a KPI insights table provided actionable suggestions based on user-defined targets, making the platform more interactive and actionable.

Improvements,

- **Visual Improvements:** Optimized the dashboard design by incorporating a KPI insights table and eliminating unnecessary visual elements (e.g., Bubble Scatter Plot).
- **Dynamic Insights:** Established the creation of actionable feedback grounded in user-defined KPI objectives.
- **Usability Testing:** Improved engagement through the refinement of data visualizations for better clarity and ease of use.

Conclusive Results,

The MVP currently offers an optimized user experience featuring distinct, actionable insights. Testing cycles guaranteed that the platform is focused on user needs and successfully meets objectives for workforce optimization and emissions tracking.

The repeated testing and enhancement procedure highlighted usability, clarity, and data-informed advancements, leading to a strong and effective MVP prototype.
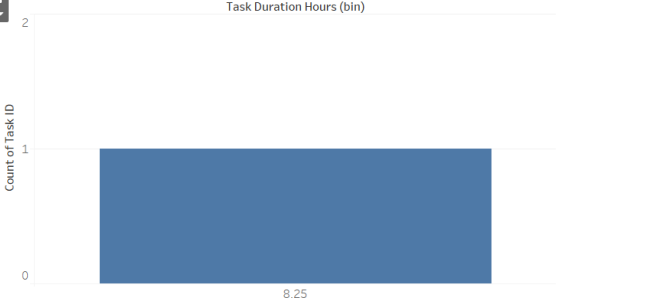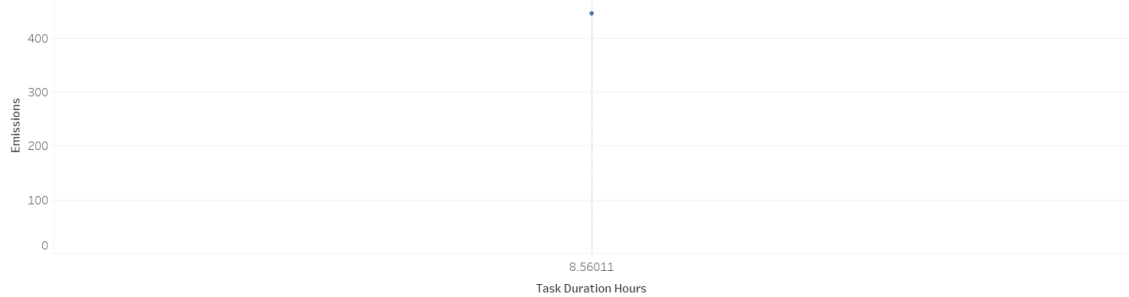
Appendix
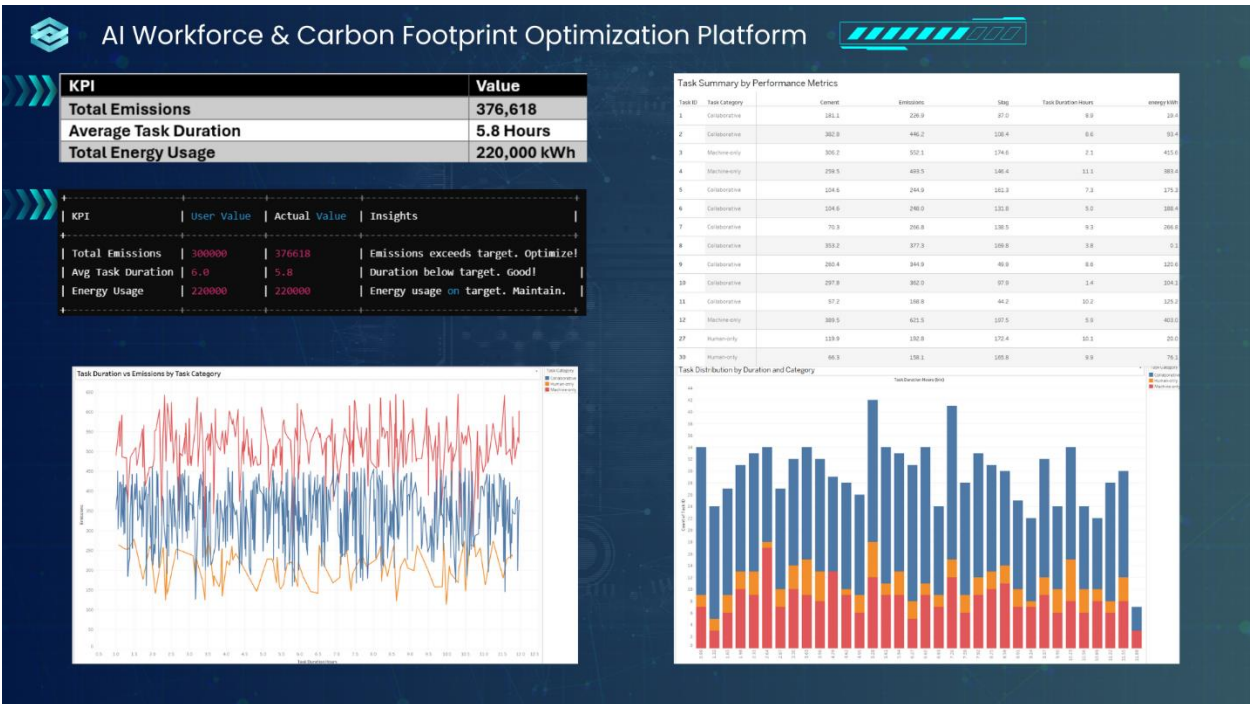
Task Summary by Performance Metrics

Task ID	Task Category	Cement	Emissions	Slag	Task Durati..	energy kWh
1	Collaborative	181.1	226.9	37.0	8.9	19.4
2	Collaborative	382.8	446.2	108.4	8.6	93.4
3	Machine-only	306.2	552.1	174.6	2.1	415.6
4	Machine-only	259.5	493.5	146.4	11.1	383.4
5	Collaborative	104.6	244.9	161.3	7.3	175.3
6	Collaborative	104.6	248.0	131.8	5.0	188.4
7	Collaborative	70.3	266.8	138.5	9.3	266.8
8	Collaborative	353.2	377.3	169.8	3.8	0.1
9	Collaborative	260.4	344.9	49.9	8.6	120.6
10	Collaborative	297.8	362.0	97.9	1.4	104.1
11	Collaborative	57.2	168.8	44.2	10.2	125.2
12	Machine-only	389.5	621.5	197.5	5.9	403.0
27	Human-only	119.9	192.8	172.4	10.1	20.0
30	Human-only	66.3	158.1	165.8	9.9	76.1

Task Distribution by Duration and Category

Task Category
■ Collaborative

Task Duration vs Emissions by Task Category

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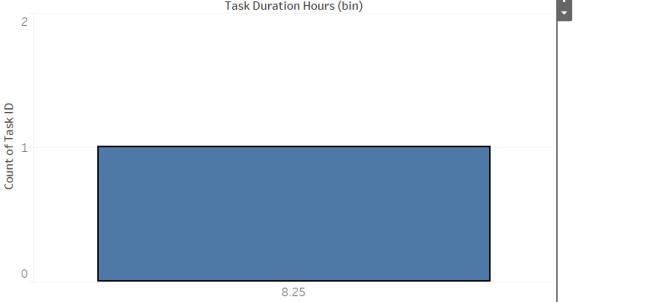

Task Category
Collaborative

Task Duration vs Emissions by Task Category

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Task Distribution by Duration and Category
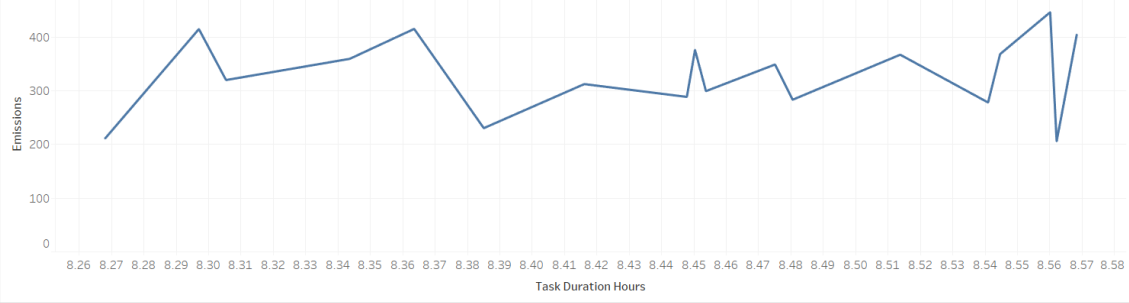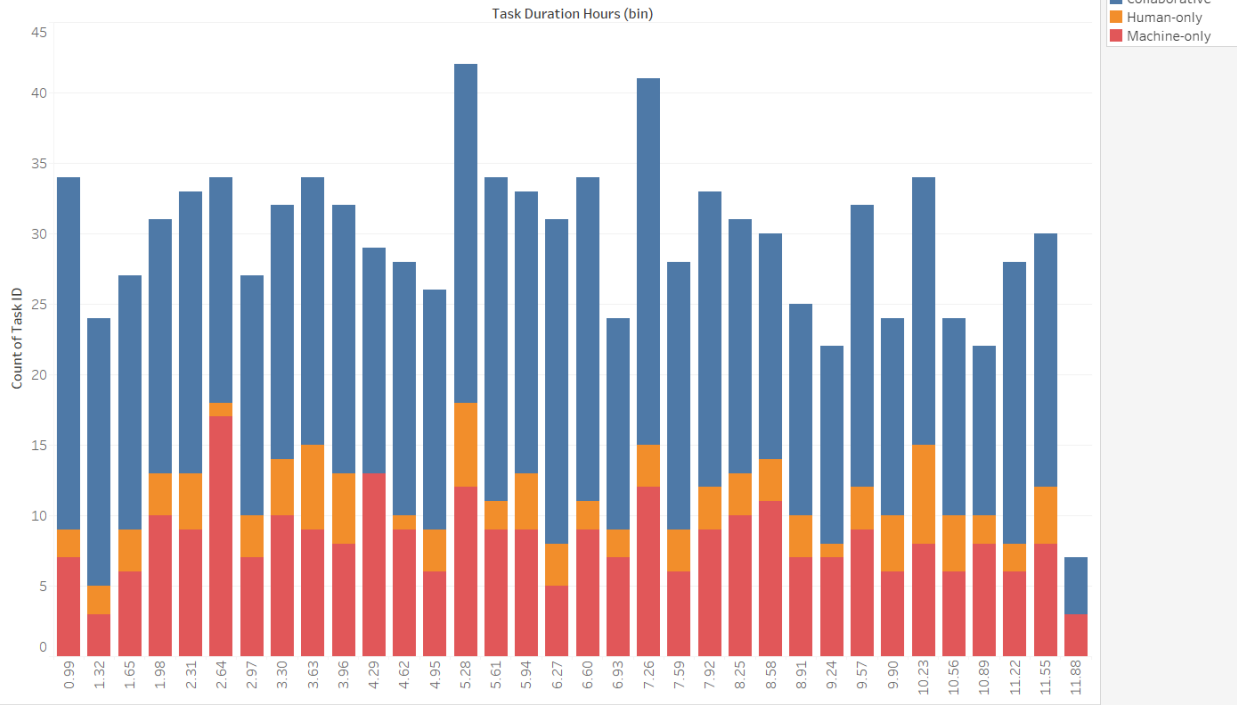
Task Duration vs Emissions by Task Category

Task Category
- Collaborative
- Human-only
- Machine-only
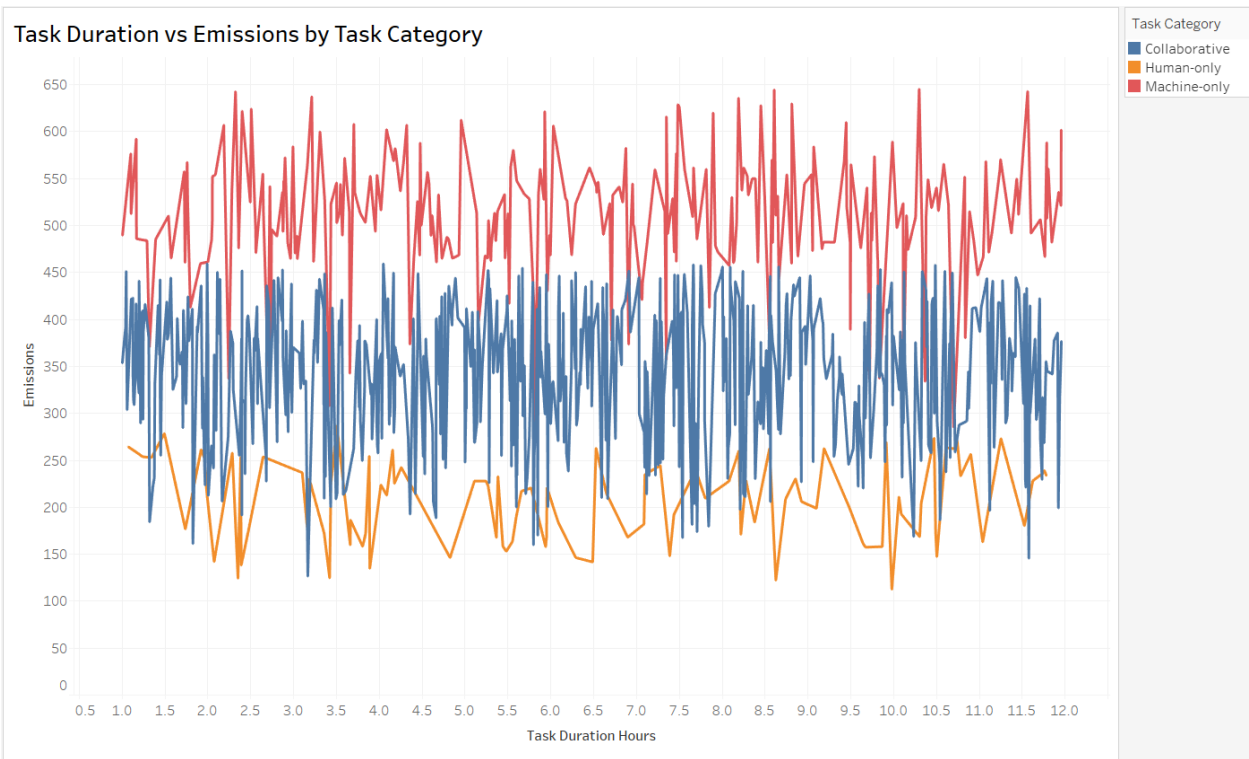
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+------------------+----------------+----------------+-----------------------------------------+
| KPI              | User Value     | Actual Value   | Insights                                |
+------------------+----------------+----------------+-----------------------------------------+
| Total Emissions  | 300000         | 376618         | Emissions exceeds target. Optimize!     |
| Avg Task Duration| 6.0            | 5.8            | Duration below target. Good!            |
| Energy Usage     | 220000         | 220000         | Energy usage on target. Maintain.       |
+------------------+----------------+----------------+-----------------------------------------+
```

Task_ID	cement	slag	ash	water	superplastic	coarseagg	fineagg	energy_kWh	task_duration_hours	worker_count	emissions	task_category
1	181.089	37.02659	39.25585	234.5406	11.43991757	775.5448642	753.7798679	19.39972736	8.922947163	5	226.8922	Collaborative
2	382.75	108.3802	37.04682	259.3363	16.10864659	831.4049616	420.6704535	93.38626412	8.560113049	2	446.1813	Collaborative
3	306.1979	174.5892	135.9382	150.0936	15.2032186	1098.183175	910.6761943	415.6229025	2.053296185	4	552.0812	Machine-only
4	259.5305	146.445	37.43193	224.9748	3.077998094	738.0030702	729.1813673	383.3841782	11.14829645	5	493.4567	Machine-only
5	104.6065	161.3122	40.79246	214.3492	2.984989395	1108.754779	410.0427185	175.3213457	7.253194224	1	244.8896	Collaborative
6	104.5981	131.7567	113.9097	266.5661	5.363487355	561.6941017	973.6366402	188.4053139	5.000980732	1	247.9743	Collaborative
7	70.32926	138.4553	67.46098	281.2174	7.221494527	1043.758906	662.8558243	266.7772168	9.321924418	2	266.7519	Collaborative
8	353.1617	169.8391	116.5066	102.4314	8.169111628	1093.283343	351.0289163	0.120502343	3.831020042	1	377.345	Collaborative
9	260.3903	49.9336	9.804924	234.804	13.59394434	627.272357	738.7830331	120.622168	8.628608208	1	344.8602	Collaborative
10	297.8254	97.88499	73.13568	110.3672	1.133608643	801.2425727	477.2392349	104.1159043	1.436823283	1	362.0007	Collaborative
11	57.20457	44.24189	5.04204	209.7717	0.693454085	615.8498423	862.5854163	125.2414734	10.23348841	4	168.8238	Collaborative
12	389.4684	197.5336	9.397981	157.5265	7.838211259	994.6228903	872.4754515	402.9529213	5.929879317	1	621.5014	Machine-only
13	341.3549	188.8119	135.9656	161.3553	13.94327384	874.7434376	985.2631491	139.8369283	8.003622058	3	456.1642	Collaborative
14	124.3187	7.885362	20.88681	170.5917	3.868706859	944.7263427	651.3086717	95.76066103	3.433616018	5	200.4266	Collaborative
15	113.6387	141.115	79.8631	224.2585	12.83008963	637.5408769	618.4698158	252.1317304	8.447810839	1	288.5895	Collaborative
16	114.1916	185.0497	61.66434	166.81	5.196562759	648.2221034	827.4329238	432.8225182	9.494643035	1	389.3262	Collaborative
17	156.4848	36.11507	52.1015	246.5398	17.72172218	529.0481279	392.7294594	120.6748519	6.205345056	1	238.4138	Collaborative
18	233.6648	113.589	134.975	180.9055	17.91379889	725.4472746	682.8408597	39.2681214	7.794996165	3	291.9749	Collaborative
19	201.1808	183.0977	3.27351	113.6706	5.945744086	891.8212629	682.3733201	178.2023679	6.019585162	1	332.2198	Collaborative
20	151.9302	6.789196	99.56845	256.752	4.599875079	1100.55444	362.631186	373.8259123	10.83500506	1	380.2872	Machine-only
21	264.1485	139.4841	144.5092	157.1517	8.226079441	966.8492132	592.5888599	275.3452723	6.476560986	5	440.8043	Collaborative
22	98.82285	59.4698	84.02523	186.5534	4.810631704	804.7774264	897.299359	408.3966848	10.2598958	3	357.8966	Collaborative
23	152.2506	184.8792	140.5234	237.0888	13.44767687	1167.18408	899.3075354	479.7960738	9.814872641	3	463.5317	Machine-only
24	178.2266	194.2116	7.838682	166.4912	16.52129369	1003.47164	369.4663654	396.3312384	5.515553035	1	417.0378	Machine-only
25	209.6245	188.8533	62.819	111.3171	13.46184262	1151.115642	363.5046179	301.9015394	3.53092941	3	399.128	Collaborative
26	324.8116	94.84284	39.02367	174.7842	16.48700894	869.3115813	483.8868339	246.670794	5.466903458	2	465.2639	Machine-only
27	119.8858	172.4085	109.6231	288.8897	7.939843244	681.2329924	912.3362438	20.03454317	10.08839113	3	192.7641	Human-only
28	229.9821	168.9099	147.1946	228.3469	3.126339414	536.9786805	390.2318096	492.1609894	3.503957894	3	502.8984	Machine-only
29	257.3451	63.82009	38.47951	234.2958	14.75901895	1008.259396	803.9977618	191.7405613	6.768799804	3	385.7172	Collaborative
30	66.25764	165.7831	98.12619	226.4564	7.209490103	584.9120986	370.8159337	76.11410696	9.867064228	4	158.0943	Human-only

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