**EDA / Descriptive Statistics**

## **Introduction:**

Cement making used to be all about hard work, but now it's getting a big boost from automation. Machines are taking over tasks like handling materials and making sure everything runs smoothly. This makes things safer, faster, and better for the environment. With smart technology like AI and data analysis, cement factories can work smarter and be more competitive. Automation is making cement making easier and better all around .Despite initial challenges, automation promises a future of streamlined production, reduced environmental impact, and increased competitiveness in the global market.

**Overall Design Strategy:**

* \*\*Dashboard Structure\*\*: Design a comprehensive dashboard that presents key performance indicators (KPIs) related to the milling process in a structured manner. Divide the dashboard into sections, each focusing on specific aspects such as feed rates, power consumption, temperatures, and draft pressures..
* \*\*Font and Styling\*\*: Maintain consistency in font choices and styling to enhance readability and visual coherence. We Use a clean and professional font. Ensure appropriate font sizes for readability, especially for numerical values and axis labels.
* \*\*Graphical Representations\*\*: Select appropriate chart types to effectively visualize different types of data. For continuous variables like feed rates and temperatures, line charts or area charts can provide a clear depiction of trends over time. Bar charts or pie charts may be suitable for representing categorical data such as reject rates.
* \*\*Interactive Elements\*\*: Incorporate interactive elements, such as tooltips and filters, to allow users to explore the data more deeply. Tooltips can provide additional information when hovering over data points, while filters enable users to focus on specific time periods or operational parameters.
* \*\*Background and Layout\*\*: Choose a neutral background color, such as light gray or white, to reduce visual distractions and maintain focus on the data. Organize the layout of the dashboard in a logical manner, with sufficient spacing between visual elements to avoid clutter.

By adhering to these design principles, the dashboard will effectively convey insights into the milling process, enabling stakeholders to monitor performance, identify trends, and make data-driven decisions to optimize operations and ensure quality control.

## **Data Overview**

* The cement manufacturing automation dataset comprises a comprehensive array of parameters essential for monitoring and optimizing the cement production process. It encompasses key metrics such as mill feed rates, clinker and gypsum weigh feeder rates, power consumption, temperatures at different stages, and draft pressures within the ventilation system. With over so big records, the dataset offers a granular view of operational dynamics, allowing for in-depth analysis of process efficiency, resource utilization, and environmental impact. Moreover, the inclusion of real-time and historical data enables trend analysis, anomaly detection.
* Data is extracted into text files and when uploading into tableau all these files are joined based on the keys. Once the data is loaded another extract summarizing thel data is created using custom SQL.

## **Users**

Users of the visualization dashboard will be:

The primary users of the visualization dashboard for cement automation data are:

* \*\*Plant Operators and Technicians\*\*: Responsible for real-time monitoring and control of the cement manufacturing process, they use the dashboard to optimize production efficiency, and ensure smooth operations.
* \*\*Plant Managers and Supervisors\*\*: Oversee overall plant performance and make strategic decisions based on insights gained from the dashboard. They focus on maximizing productivity, downtime, and improving overall operational efficiency.
* \*\*Process Engineers\*\*: Analyze historical data, identify trends, and develop strategies for process optimization. They use the dashboard to enhance process efficiency, reduce resource consumption, and improve product quality.

## **Questions**

Questions which will be answered by this visualization:

For Plant Operators and Technicians:

* \*\*Real-time Monitoring\*\*: How is the current performance of the cement manufacturing process in terms of feed rates, temperatures, and equipment operation?
* \*\*Anomalies Detection\*\*: Are there any anomalies or deviations from expected values that require immediate attention or adjustment?
* \*\*Equipment Status\*\*: What is the current status of critical equipment such as mills, fans, and separators, and are there any indications of malfunction or degradation?

For Plant Managers and Supervisors:

* \*\*Overall Plant Performance\*\*: What is the overall performance of the cement manufacturing plant, and how does it compare to production targets and KPIs?
* \*\*Operational Efficiency\*\*: Are there any areas for improvement in terms of production efficiency, downtime reduction, or resource optimization?
* \*\*Strategic Decision-making\*\*: Based on the insights gained from the visualization dashboard, what strategic decisions can be made to improve overall plant performance and profitability?

## **Describe Visualization and how it answers the questions**

Visualization for Plant Operators and Technicians:

* \*\*Real-time Monitoring\*\*: Line charts and gauges can display current values of key parameters such as feed rates, temperatures, and equipment status, enabling operators to quickly assess the current performance of the cement manufacturing process.
* 2. \*\*Anomalies Detection\*\*: Heatmaps or scatter plots with threshold lines can highlight deviations from expected values, triggering alerts or notifications for operators to investigate and address potential issues promptly.
* 3. \*\*Equipment Status\*\*: Status indicators or color-coded dashboards can provide a visual overview of equipment status, with drill-down capabilities to access detailed information on specific equipment components and performance metrics.

Visualization for Plant Managers and Supervisors:

* \*\*Overall Plant Performance\*\*: Dashboard summaries and trend analysis charts can provide insights into overall plant performance metrics such as production output, downtime, and energy consumption, allowing managers to assess performance against targets and identify areas for improvement.
* \*\*Operational Efficiency\*\*: Comparative bar charts or pie charts can visually compare actual performance metrics with targets or benchmarks, highlighting areas where efficiency gains can be made through process optimization or resource allocation adjustments.
* \*\*Strategic Decision-making\*\*: Interactive dashboards with drill-down capabilities can facilitate strategic decision-making by providing detailed insights into operational trends, performance drivers, and potential optimization opportunities, enabling managers to prioritize and implement actionable initiatives effectively.

## **Conclusion**

In conclusion, navigating the complexities of cement manufacturing automation data, particularly with its extensive volume, demands more than just numerical aggregation. Visualization emerges as a pivotal tool, offering a holistic view across various parameters. It provides rapid insights for informed decision-making, allowing stakeholders to pinpoint inefficiencies and optimize processes promptly. Moreover, with advancements in automation technology, such as real-time monitoring and predictive analytics, visualization becomes indispensable for unlocking deeper insights and driving continuous improvement in cement manufacturing operations.