Elevating Efficiency: Implementing Industry 4.0 at Eaton's LVA Manufacturing Center

Team 4 - Eaton
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The function of a LVA (Low Voltage Assembly) is to provide electrical protection against thermal and mechanical stresses of short circuit currents. This is crucial in limiting the dangerous consequences of excessive currents and separating the defective current from the rest of the installation.
Problem Overview

- The project endeavors to establish a world-class Engineer-to-Order Low Voltage Assembly center in El Paso, TX, for a futurist data center that will be develop by a company in the Computers Industry. By leveraging Industry 4.0 technologies, the UTEP Senior Design Team aims to optimize a new assembly line for a completely new LVA product, collaborating closely with EATON to integrate sustainability, safety, and standardization practices. The project emphasizes efficiency improvements, regulatory adherence, and meeting the dynamic market demands for innovative electrical solutions.
Objective

We were provided with the proposed layout. This assembly line will produce Low Voltage Assembly Units, and the first goal was to verify and validate that the current layout propose is accurate and will be able to meet all the requirements needed.
During the past 3 months, we have been collaborating closely with Eaton’s engineers, plant manager and workers to improve and optimize the proposed layout that we collaborate to produce. Getting into workshops, we all analyze what we see on paper to transfer it to real life, so we can obtain possible problems that the assembly line may encounter.

Communication within the team and with Eaton engineers

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<tr>
<th>Area</th>
<th>Activity/Task</th>
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<th>End</th>
<th>Date</th>
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Communication within the team and with Eaton engineers

- Built kit carts, work tables and line components with plastic tubes and cardboard to visualize and simulate assembly line.
- Implemented a 5S workshop with the collaboration of Eaton Employees.
- Removed old tape from the floor and taped the corners of all the components in the line.
- Finishing up any last modifications to the poster, simulation and presentation.

- Feb 6
- Feb 9-Feb 19
- Feb 23-Mar 1
- Mar 5-Mar 8
- Mar 11-Mar 23
- Mar 26-April 5
- Apr 9-Apr 12
- Apr 14-Apr 23

- Met with Eaton engineers and project managers to discuss project objectives.
- Collaborated with Eaton employees in workshops to meet project requirements based on lean manufacturing methodologies.
- Gathered information provided by Eaton to start working on poster, presentations, report and simulation.
- Designed and improved more kit carts and line components considering ergonomics for the operators.
Methodology

The CAD Drawings and Layouts for the new LVA assembly line have been defined and were ready to be implemented using Industrial, Manufacturing, and Systems concepts. The objective is to validate what has been defined electronically (CAD Drawings) in order to be safe, efficient and functional. Many methodologies were implemented throughout the whole collaboration process between UTEP Senior Design students and EATON Employees.

"Not every technique is one-size-fits-all"

or

"Each technique isn't a universal solution."
Methodology: Engineering Design and Techniques

For the hands-on aspect of this project, Eaton's engineers used, for the most part, the Lean 3P (Production, Preparation, Process) methodology, as depicted in the movie "The Founders." This approach, known for its emphasis on innovation and efficiency, guided our team through the design process. To ensure the feasibility of EATON CAD layout proposal, EATON conducted a series of Rapid Improvement Workshops in collaboration with UTEP students. These workshops facilitated constructive feedback and fostered a culture of continuous improvement within our project.
Methodology: Industry 4.0 and Engineering Concepts/Principles

EL Paso, TX:
- 80% Hispanics
- The average height:
  - Man is 5’9
  - Woman 5’4
Ergonomics

After reviewing Eaton's current kit carts and worktables, we identified an opportunity to enhance them using Creeform materials. This decision was informed by a demographic study we conducted, leveraging data from Electronic Medical Records (EMR) and the U.S. Census Bureau. Our analysis revealed that the average height of Eaton's workforce is between 5'4" and 5'9", including both men and women of Hispanic descent. Based on this data, we opted to set a height limit of 5 feet for the components. This modification aimed to improve accessibility and safety for operators, ultimately enhancing their performance.
Ergonomics
Industry 4.0

Below is the virtual reality video that was provided to us by Eaton management which shows the assembly lines layout with all its required components as well as our Industry 4.0 simulation. The VR video aided us with the design of the simulation as it allowed us to effectively oversee the layout with the approach to propose this tool to Eaton for future advancements.

AI Video
https://drive.google.com/file/d/1g5CaZgc4dtJtBo4FWNdAQDCBLjBdUiqh/view
Results

• For our results we were able to validate the assembly line's layout with our industry 4.0 simulation as well as our successful collaboration with Eaton employees through our lean manufacturing workshops. We verified that the layout of the line will have a continuous flow with a pull system being integrated and most importantly a safe environment for the operators to work.
ABET 2: ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

JACK

Electronic Medical Record (EMR) and U.S. Census Bureau Data

EL Paso, TX:
- 80% Hispanics
- The average height:
  - Man is 5'9,
  - Woman 5'4
ABET 3  Effective Communication

Clarity and Understanding

Coordination and Collaboration

Problem solving and decision making
ABET 5: function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

During the past 2 months, we have been collaborating closely with Eaton's engineers, plant manager and workers to improve and optimize the proposed layout that we collaborate to produce. Getting into workshops, we all analyze what we see on paper to transfer it to real life, so we can obtain possible problems that the assembly line may encounter.

- Space between structures
- Cranes positioning
- Ergonomic workstations
- Compliance with measurements
ABET 7: APPLICATION OF NEW KNOWLEDGE AND LEARNING STRATEGIES

Since the start of the project, Eaton has provided us with some great knowledge regarding different methodologies that are helpful for optimizing the assembly line. This methodologies have been useful tools to deliver potential and professional solutions as well getting us closer to our goal. Throughout this project we have incorporated Industry 4.0 solutions which is known as technological advancements such as simulations, data analysis or even ergonomic report which we used to verify and demonstrate positive results to our project mentors. We also know that technology is advancing rapidly in today's world, and we are not far away from Industry 5.0 being the essential piece for manufacturing processes and optimization.

Below is a video that demonstrates how Eaton started to use Industry 5.0 in the installation of the LVA Assembly line.

AI Video
https://drive.google.com/file/d/1g5CaZg

101x44
https://drive.google.com/file/d/1g5CaZg

101x44
https://drive.google.com/file/d/1g5CaZg

c4dtJtBo4FWNdAQDCBLjBdUiqh/view
Conclusion
Acknowledgements

**UTEP Faculty and Teachers:** "A sincere thank you to the esteemed faculty and teachers of UTEP, especially to Dr. Fashiar Rahman, Dr. Sergio Luna, and Dr. Contreras for their guidance and mentorship to our project journey. Your expertise and support have been instrumental in shaping our growth and success."

**EATON Management and Employees:** "We extend our heartfelt gratitude to our project sponsor EATON, especially to Jorge Mena, Eduardo Quiroz, and Danny Gonzalez. Your invaluable contributions and expertise have significantly enriched our work and propelled us towards excellence."

**Team Members:** "To our incredible team members, Jose Graells, Eduardo Jaquez, Ivan Delgado, Roberto Torres, thank you for your hard work, creativity, and relentless determination. Your passion and teamwork have made this journey both rewarding and memorable."
Thank you!!