Senior Capstone Projects
Spring 2014

Project: Layout and Production Control System for a Ceramic Tile Company

Contact:
Wendy Kleiner
HighFire Designs
Bozeman, MT 59715

Description: HighFire is a small start-up company in Bozeman that designs and manufactures decorative ceramic tile for the residential housing sector. They have a fairly diverse line of product for which they mold the clay, cut it into tile, glaze and fire the tile, and package it for sale to their customers. They have recently landed a contract with a major national distributor, and expect sales volume for several product lines to grow significantly over the next year.

HighFire is in need of a revised layout to the production area of their facility that will enable them to smoothly and profitably meet the expected increase in demand for their products. The increase in volume will also create a need for a more structured production control system to keep track of orders from the front office all the way through to shipping, as well as inventory management system.

The objective of this project then is to create a facility layout that will meet forecasted demand, and an associated production control system to optimize the utilization of production resources, maintain predictable production lead-times, and minimize waste.

Team Members:
James Black
Sam Helm
Ciarra Ioli
Annelise Weinmann

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Project: Work Cell Design for Plastic Part Production

Contact: Joe Johnson
Plastic Design and Manufacturing
210 Wooden Shoe Lane
Manhattan, MT 59741

Description: Plastic Design and Manufacturing (PDM) is a plastic injection molding shop. For their largest customer, they produce plastic parts that attach to the feet of step ladders. This product requires post-processing of the parts, including several assembly steps, before packaging. They produce in excess of 50,000 parts per week of this product, in four variations, with an increase in orders expected in the first quarter of 2014. The current work cell has seen some development work, but plant management sees additional opportunity for further improvement

The objectives are the project are to:

- Analyze the ladder feet post-press production process and workflow to identify non-value added tasks and processes.
- Determine an optimal work cell design which reduces production costs, reduces job cycle time, improves ergonomics, and minimizes material travel distance while ensuring a high standard of quality. This includes the possible option of programming the PLC robot picker mounted at the press to retrieve parts from the mold.
- Implement mistake-proofing (poka-yoke) for the process through visual controls, a 5S system, and other means.
- Design an inventory control system to ensure efficient material replenishment to the work cell and reliable control of raw materials inventory.

Team Members: Will Bryan
Brent Gilliam
Erica Pimley

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Project: Development of a Scheduling Tool for Plastic Injection Molding Operations

Sponsor:
Christopher D. Wilkerson
ATK Tactical Systems – BLACKHAWK!
275 Manhattan South Rd.
Manhattan, MT 59741

Description: ATK-Blackhawk! manufactures accessories for sportsman, military, and police, and security personnel. Their production operations include 30 plastic injection molding machines which produce products and components for the Blackhawk! brand as well as other ATK companies and partners.

Currently, the company is experiencing missed deliveries of product to internal and external customers, estimated at 1-6 missed deliveries per week. Most misses are associated with accidental scheduling of a product (mold) to run in a specific machine not capable of that specific product type. The planning and scheduling team relies heavily on tribal knowledge of processes to assign work orders to machines, with no true reference tool of machine capabilities. This is a complex decision process with many variables that must be considered when assigning a particular work order to a machine, e.g., plastic type, machine tonnage, mold type and condition, colorant/additives, and so forth. Therefore, there is a need for a tool to improve the scheduling process for the plastic injection molding machines.

The primary objective of the project is to increase machine utilization across the machines dedicated to non-Blackhawk! production while improving on-time delivery. The project deliverable will be a user-friendly system for making work order assignments that accounts for part-to-machine compatibility as well as other factors that would affect machine uptime (e.g., raw material availability and previously scheduled jobs). It is envisioned that the system will include a reference matrix, set of guidelines, or expert system related to part-to-compatibility; an improved visual planning tool over the current FIFO slide system; and set of standardized work instructions on making work order assignments that will maximize machine utilization and the likelihood of on-time delivery.

Team Members:
Raleigh Burt
Brittani Nickol
Taylor Steed

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Project: Development of a Capacity Requirements Planning Tool for Semiconductor Fabrication

Contact:
Silvia DiRocco
R&D Operations Planning Manager
Micron Technology, Inc.
Boise, ID

Description:

Micron Technology, Inc. is a semiconductor design and manufacturing company based in Boise, Idaho. A multibillion dollar, multinational company, they design and produce memory and storage devices for customers world-wide. They produce wafers and chips in numerous locations, including Boise.

One of the jobs of the R&D planning group is to conduct capacity planning for the company's fabrication facilities. The current planning process involves manual inputs to an SQL-based tool, which uses stored inputs such as process times, process flow, tool counts, etc. to compute capacity requirements versus availability by workstation over a period of time. From this information they build a production plan from the ground up using a three-year forecast in order to estimate the number and type of tools that will be needed for their complex fabrication processes. Whenever the forecast is updated, e.g., a revised product mix, the entire exercise must be repeated in order to make sure the capacity plan is still current. The planning team sees tremendous opportunity in having a tool to help them with this very important task and increase the team's productivity while producing a highly reliable and optimized capacity plan.

The goal of the project is to create a capacity requirements planning tool that would input different planning scenarios (e.g., product mix and volume forecasts), and generate a capacity analysis report helpful for capital and capacity studies. Desired elements in the report include maximum production rates by workstation and by product type over time, required equipment counts over time by product type, and critical dates for acquisition or decommissioning of equipment. The tool may be in the form of an Excel macro, a web-based platform, or other platform as recommended by the student team in concert with the sponsor. The sponsor will provide historical data that can be used for development purposes.

This project will involve travel to Boise in early to mid-January to meet the sponsor, tour the fabrication facilities, and understand the full scope and extent of the project. Thereafter, the team will use distance technology to communicate with the sponsor.

Team Members:
Jack Andenoro
Ryan Cape
Matt Hall
Spenser Ross

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Project: Improving the Advanced Care Planning Processes for High LACE Score Inpatients

Contact: Kathryn Borgenicht, MD
Internal Medicine Associates
Bozeman Deaconess Health Group

Description: An Advanced Care Plan involves learning about the types of medical decisions that might need to be made, considering those decisions ahead of time, and then letting others know about, often by putting them into an *advance directive*. An advance directive is a legal document that goes into effect **only** if the patient becomes incapacitated and unable to speak for his or herself. This could be the result of disease or severe injury, regardless of age. It helps others know what type of medical care the patient wants.

LACE is an acronym for Length of stay, Acuity of admission, Co-morbities (as measured by a Charlson Score) and number of previous Emergency visits in the previous six months. Patients admitted to the hospital receive a LACE score to indicate the severity of their medical condition.

Bozeman Deaconess Health Group desires that all patients with high LACE scores have an advanced care plan documented in the medical record and available to hospital staff, so that they know the wishes of patients should they become unable to communicate. However, the existing processes for doing so are not yet 100% reliable.

The project involves an in-depth assessment of the current work processes for identifying and locating the ACP's of patients admitted to the medical floor (possibly also the intensive care unit) with high LACE scores, and resulting activities (e.g., advanced care consultation if not ACP found, issuing providers orders for life-sustaining treatment at discharge, etc.). The engineering team is expected to develop recommendations grounded in root cause analysis, with the possibility of implementing some subset of those recommendations on a trial basis. The objective is to significantly increase the proportion of severely ill patients who have accessible ACP's.

Team Members: Alex Bones
Blake Lerner
Molly Wyman
Emily Zerbel