Instructor
Fadel M. Megahed, fmegahed@auburn.edu, 3301L Shelby Center, (334) 844-8273

Course Motivation and Description:
Manufacturers typically have 5-8% of their production time lost due to unplanned downtime, resulting from poor maintenance, quality, and supply chain management. These unplanned downtimes are extremely costly. For example, it is reported that every minute of production downtime in an automotive assembly plant costs an estimated $21,000, which would result in an about $13 million in expenses (potential savings) per plant per year. More importantly, these expenses represent a fraction of the inefficiencies in these plants since they do not encompass the costs associated with suboptimal product sequencing, and the opportunity costs that arise from an inability to process data from multiple streams within and outside the organization.

Therefore, in this class, we will explore how engineering principles can be used to transform manufacturing operations such that we reduce downtime, increase efficiency and productivity. It is important to note that the learning in this class is designed around one (or multiple) opportunities for experiential learning. The students will be provided with a budget of $2-3K, and given access to a 3D laser scanner and, potentially, a $10k torque system. Accordingly, the students will perform a SWAT analysis to the Lego Lab and identify the main issues that affect the takt time, productivity and/or quality. Using the insights from such analysis, the students will then propose one (or several) projects that will help transform the Lego lab capabilities. These proposals will be evaluated by a faculty committee from the INSY Department. The faculty will provide feedback and insights on how to increase the impact of the proposed projects as well as their feasibility. Based on these insights, the students may modify their proposals and then, implement their work. In addition, the students will document how their work to showcase the before and after conditions.

The successful completion of the class will ensure that the students have an ability to propose an engineering project, market it, develop a bill of materials for the equipment needed, allocate resources to that project and implement it using knowledge gained from several engineering principles. In addition, the students will become knowledgeable of effective brainstorming techniques and accelerated problem solving methodology. Furthermore, the student’s technical skills, programming and marketability will be greatly enhanced.

Learning Objectives:
Having successfully completed this course, the student will be able to:
• Apply critical thinking to identify and define problems that are critical to an organization’s short-term and long-term success;
• Develop a project management plan for engineering projects;
• Describe procurement methodologies in the US government and the State of Alabama;
• Design and implement machine vision systems that can be used for product inspection and material handling; and
• Communicate engineering projects effectively.

Deliverables: The students will:
• Develop project proposal indicating economic justification, resources needed and Gantt chart (by the end of the 2nd week of the semester);
• Implement the project; i.e. design/order/manufacture any needed fixtures, create code needed to run the systems (if needed), integrate their work with the existing lab facilities, document the benefits from the project, etc;
• Blog about the project to help showcase AU engineers capabilities and skills (optional, but would be very cool 😊);
• Develop a User Manual that helps future users and students from understanding how your systems work;
• A final presentation describing the work done during the semester. You should also create two videos; one that document the whole process and another that can be used for marketing purposes.

**Course Grading:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Proposal</td>
<td>10%</td>
</tr>
<tr>
<td>Project Evaluation</td>
<td>70%</td>
</tr>
<tr>
<td>Final Videos</td>
<td>10%</td>
</tr>
<tr>
<td>Final Presentation</td>
<td>10%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

**Credits:** 3 credits (course is limited to a max of 10 students, instructor’s approval required)