Name of Project: Costing and Profitability Measurement System

Abstract:
The railroad industry plays a huge part in shipping goods across the country and helps keep the United States economy alive. The consolidated profit measurement system (CPMS) used at Union Pacific (UP) determines the cost and profitability for each equipment move across UP’s rail network. CPMS pulls data from many different sources within UP and allocates total costs (labor, fuel, track rental, infrastructure development, corporate overhead, equipment depreciation, etc.) to each car and container. The analysis of historical CPMS results supports the evaluation of past profitability and implementation of knowledge-driven change in UP’s operating processes. The users of CPMS require regular aggregated data reports as well as the ability to perform ad-hoc evaluations. The biggest problem with the system today is that it is very difficult to update and sits on outdated technology. In addition, there is no user interface for the business group to visualize data sets, manipulate the database, analyze results, or print reports.

The student team of data analysts and developers, supported by current UP business partners and IT, will continue the work that the 2018 MDP group began. This work will consist of implementing costing equations, updating existing database tables as well as creating new ones, designing and implementing new costing processes, implementing and updating a new user interface, and validating new data sources. The CPMS project is large and complex. The scope of this project goes beyond 2 years of work, so the 2019 team, with UP’s help, will also be responsible for documenting their efforts, prioritizing the next set of tasks, and handing off the project to the 2020 MDP group.

UP Development Environment

The UP technology stack has many options (see the skills section for technology versions that UP utilizes). New production systems use a Java backend leveraging Angular JS/HTML for the frontend. Students will be able to access the environment via virtual machines in the UP system.

Front end developers are expected to implement and update screens and tie them to the server side using Spring MVC. Back end developers are expected to design and code processes which connect to the database and potentially the front end. Both sets of developers are expected to work with the database which is housed in an Oracle environment.

Scope:

**BASELINE GOAL (end of 1st semester)**

(Role 1) 1 UI screen implemented and tested for database access, analysis, and management

(Role 2) Completion of java batch program which manipulates costing data, runs through 30+ pre-written equations, and produces cost results at a detailed level

(Role 3) Validation of new system cost results and comparison of new results against the old mainframe system
Final Deliverable

(Role 1) 1 UI screen implemented and tested for correcting previously run costs, analyzing the impacts of the corrections, and allowing user interaction with the database

(Role 2) Design and implementation of java batch program which links finalized costing results together for monthly reporting

(Role 3) In depth research and documentation of new data source – finding any discrepancies or missing data in comparison with the existing data source

Include Stretch Goals and Details here: HIGH SUCCESS

(Role 1) Enhance existing UI functionality – export cost results into PDF reports and excel spreadsheets, update visualization/mapping to include more data sets, create monthly reports

(Role 2) Design and implementation of Correction process – allowing users to correct previously run costs on an ad hoc basis.

(Role 3) Design and specifications for additional processing – to include audits and estimates created within the daily costing process

Student Skills:

<table>
<thead>
<tr>
<th>Project Roles</th>
<th>Key Skills and/or Knowledge</th>
<th>Likely Majors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front End Programming (2 - 3 Students)</td>
<td>General programming, Problem solving, Positive attitude, Motivated and willing to learn</td>
<td>CSE/CS-LSA, Data Science,</td>
</tr>
<tr>
<td>Back End Programming (6 students)</td>
<td>General programming, Problem solving, Positive attitude, Motivated and willing to learn</td>
<td>CSE/CS-LSA, Data Science, MIDAS</td>
</tr>
<tr>
<td>Data Analysis, Validation, Project Management, Process Design (2 Students)</td>
<td>Business process analysis, Experience with writing SQL, Diagramming and documenting processes, Statistical analysis, Database Design, Project Management</td>
<td>IOE, Data Science, MIDAS, Statistics, BBA (with CS minor), CS (with BBA minor)</td>
</tr>
</tbody>
</table>

Desired Additional Skills:

Any of the following Skills, Knowledge or Experience would be valuable to the 2019 team. We don’t expect students to be familiar all or even most of these items, but strong candidates will have familiarity or experience with some of them and a positive attitude to learn what is necessary as the project gets underway. Please highlight your experience with any of the items on this list in your personal statement on the application.

- Willingness to understand business problems and design and implement the solution.
- Success and interest in team-based project work.
• Proactive working style.
• An interest in business processes, big data, and project management.
• Functional experience in Finance, Marketing, Sales and/or Business Analytics.
• Practical experience Handling Complex Data Sets.
• Database experience, particularly Oracle or SQL Server.
• Experience with Java 8, Angular JS 1.6.9, HTML5.

Location:
All project work will take place on campus, with an opportunity to visit Union Pacific’s headquarters in Omaha, NE during spring or fall break.

Sponsor Mentor:
Addison Parker joined Union Pacific in 2016 in UP’s Corporate Systems Group supporting Financial Applications. In the past couple of years with the railroad, Addison has accumulated multiple IT responsibilities including software development and project management work on several systems. The systems are largely financial in nature and include predictive costing, invoicing, and revenue, which includes all of freight revenue totaling more than $20 billion per year. Prior to joining UP, Addison was a student at the University of Michigan in the College of Engineering. She has a Bachelor of Science degree in Computer Science and a minor in Multidisciplinary Design. Addison was a member of the 2015 Union Pacific Multidisciplinary Design Team.

Project Manager:
Dani Lucht joined Union Pacific in 2014 in UP’s Corporate Systems Group supporting Financial Applications. Since 2015, Dani has been the primary project manager for 3 MDP groups – all working with UP’s costing applications. Two of the previous teams’ projects have been completed and are currently in use by UP’s costing and marketing teams. Dani’s experience at UP spans multiple projects. Primarily, those projects are data oriented and revolve around statistics or cost. Dani graduated from the University of Nebraska – Lincoln with a Bachelor of Arts in Anthropology and History. Afterwards, she graduated from Bellevue University with a Master’s of Science in Computer Information Systems.

Faculty Mentor
Bill Arthur
Computer Science
Legal Requirements:
Citizenship Requirements (please select)
• This project is open to all students regardless of citizenship status.

Intellectual Property Agreements / Non-Disclosure Agreement Requirements (please select)
• Students will sign the standard MDP IP/NDA agreement

Internship Information (please select)
• Paid Summer Internships are required and guaranteed for all students on our student team. Internships will take place in Omaha, Nebraska at Union Pacific Corporate Headquarters. Housing is provided as part of the internship.

Company Information:

Union Pacific Railroad Fast Facts

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route Miles</td>
<td>32,100</td>
</tr>
<tr>
<td>Employees</td>
<td>42,000</td>
</tr>
<tr>
<td>Annual Payroll</td>
<td>$4.1 billion</td>
</tr>
<tr>
<td>Communities Served</td>
<td>7,300</td>
</tr>
<tr>
<td>Capital Spending 2017</td>
<td>$3.1 billion</td>
</tr>
<tr>
<td>Capital Spending 2008-2017</td>
<td>$34 billion</td>
</tr>
<tr>
<td>Locomotives</td>
<td>8,600</td>
</tr>
<tr>
<td>Customers</td>
<td>10,000</td>
</tr>
</tbody>
</table>

America's Premier Railroad Franchise

Union Pacific Railroad is the principal operating company of Union Pacific Corporation (NYSE: UNP). One of America's most recognized companies, Union Pacific Railroad links 23 states in the western two-thirds of the country by rail, providing a critical link in the global supply chain. From 2007-2012, Union Pacific invested $18 billion in its network and operations to support America's transportation infrastructure, including a record $3.7 billion in 2012. The railroad's diversified business mix includes Agricultural Products, Automotive, Chemicals, Coal, Industrial Products and Intermodal. Union Pacific serves many of the fastest-growing U.S. population centers, operates from all major West Coast and Gulf Coast ports to eastern gateways, connects with Canada's rail systems and is the only railroad serving all six major Mexico gateways. Union Pacific provides value to its roughly 10,000 Customers by delivering products in a safe, reliable, fuel-efficient and environmentally responsible manner.

Appendix:

Project Nuts & Bolts
The following items will not be shown to students in the project description but they do need to be finalized before we can match students to the project.

- List of internal stakeholders can the students interview for contextual design needs. (Ideally students should have 8-10 different individuals they can interview as end-users for the project) These interviews/brief meetings should occur in January. Required for software development-based projects, ideal for prototype or interface projects.
  - Holly Stockman, Benjamin Carrick, Ross Olsen, Doug Withers, Darice Limpp
- Development Environment: if there is code or modeling, which version/license of the software should they use? Where will the code/development environment live?
  - All of the software that we require will be available via the UP virtual machines. All of the code will live within the UP environment via virtual machines.
- Is there any equipment (test equipment, robotic arm, vehicle, etc) that you plan to loan to the students for use on your project team? Lab space is limited at UM, we'll need to make requests early.
  - No