Lab 1 – Power Play Product Description

Black Team
Terrell Kittrell

Old Dominion University
CS 411W
Janet Brunelle

March 3, 2017
Version 2
Table of Contents

1 Introduction ................................................................................................................................... 3

2 Power Play Product Description ................................................................................................. 4
   2.1 Key Product Features and Capabilities ................................................................................. 4
   2.2 Major Components (Hardware/Software) ........................................................................... 5

3. Identification of Case Study ......................................................................................................... 6

4  Power Play Product Prototype Description ............................................................................. 7
   4.1 Prototype Architecture (Hardware/Software) .................................................................... 8
   4.2 Prototype Features and Capabilities ................................................................................... 8
   4.3 Prototype Development Challenges ................................................................................... 10

Glossary ......................................................................................................................................... 11

References ...................................................................................................................................... 13

Figures and Tables

Figure 1 Major functional component diagram .............................................................................. 6
Table 1 Feature comparison between full product and prototype .................................................. 9
Lab 1 – Power Play Product Description

1 Introduction

Dominion Resources (Dominion) is the largest utility company in Virginia and one of the largest producers and transporters of energy in the country. With a portfolio of 26,400 megawatts of generation, Dominion serves more than 6 million utility and retail energy customers (Dominion Virginia Power, "Company Profile", 2012). In 2013, Dominion made a five year commitment to spend $14 billion for new and upgraded energy infrastructure, to ensure continued service reliability, a legacy of public service and responsible environmental stewardship ("Annual Reports", 2014). Part of this five year commitment includes grants to higher education institutions to invest in the next generation of engineers and energy management professionals.

One such investment was made to two Old Dominion University researchers with the goal of improving energy decision-making. Professor Mamadou Seck and Professor Erika Marsillac received a $35,000 grant to fund an innovative approach to equipping students in engineering and energy management with skills to help utility companies such as Dominion. Their innovative approach is Spark!, a simulation engine that will engage students in virtual scenarios based on real life situations that Dominion faces everyday. The user interface of the Spark! engine, Power Play, will be developed by the team with the goal of delivering a functional prototype in May 2017 ("ODU Engineering, Business Professors Designing Game to Help Dominion Virginia Power with Energy Decisions", 2016). This tool will improve proactive decision making and facilitate it happening in less time.
Power Play, conceived by the grant receivers in conjunction with the CS 410 Black
Group, is a game that will provide risk-free simulated environments in which gameplay decisions
will give actionable feedback that will improve decision making in the real world. It is designed
to give a strategically analyzed decision making approach based on geographical regions and
predefined scenarios and increase proactive versus reactive decision making. Over time, player
decision making can be analyzed to improve Dominion’s decision making process and provide a
measurable positive impact on company revenue.

2 Power Play Product Description

Power Play is a free to play game that will be available on any device with access to a
browser. The front end of the Spark! simulation engine will provide users with a friendly way to
improve their energy decision making, access analysis of other players decisions and
create/optimize best practices for energy management. The results from analysis of gameplay
will provide utility company training staff with information to improve classroom instruction as
well as new employee onboarding for project managers, plant technicians, executives and other
employees involved in the decision making process of energy planning.

2.1 Key Product Features and Capabilities

Power Play takes the devices that many users are familiar with, desktop, tablet, mobile
device and gives access to a powerful and innovative way to further their energy management
skills. Through a user’s personal account and profile, they can engage in multiple simulated
scenarios that will reward them with achievements to measure their progress. This progress
measurement will also be useful for management, professors and others in higher positions when
evaluating these employee or students. Instant feedback during post-game analysis by the
simulation engine will assist in ensuring the informed decisions are being made in real life
scenarios to achieve maximum intended impact. Rankings of performance will add a competitive element to encourage engagement as well as indicate who should be making the final call in emergency situations.

2.2 **Major Components (Hardware/Software)**

Figure 1 illustrates the major functional components of the Power Play real-world product. The Power Play Linux web server, which host all front-end files of the website built with Flask, a Python microframework, will allows users to use any browser cable device such as a desktop, tablet or phone to use Power Play. The front-end will provide functionality to create an account, start a simulation, profile management and check rankings.

The website will use Mongo databases to store player and gameplay information as well as results from player decision making. This will allow recall of past simulation results as well as player input to feed reporting screens in the front-end. This will also feed ranking information and analyzed reporting data to the user interface. These databases will be connected via API to the Spark! simulation engine which will provide all of the variables and mathematical conclusions of input given by the user.
3 Identification of Case Study

Power Play will be targeted at two primary industries. One vertical is utility companies such as Dominion. Which has generously given a $35,000 grant to Professor Mamadou Seck and Professor Erika Marsillac to fund this innovative project to equip students in engineering and energy management. These utility companies can use Power Play to improve proactive decision making, decrease the iteration time during the decision making process, get instant feedback on environmental impact and use reports, and analysis for in-house training programs.

The second vertical is higher education institutions such as Old Dominion University. Professors can use Power Play to simulate past real life scenarios from utility companies such as
storms, population growth, power plant decommissioning, new regulations and use the platform to train students. This will give them applicable skills they can use on day one of their job in energy management or engineering to perform better and impact company revenue and decision making.

4 Product Prototype Description

The Power Play prototype is designed to demonstrate that a simulation engine for the energy management process in utility companies is feasible. Also, these simulations and variables can be analyzed and reported in a meaningful way to decision makers and training staff. Many of the analysis components will be eliminated from the prototype demonstration. Table 1 in section 4.2 contains an exhaustive list of features to be eliminated or implemented.
4.1 Prototype Architecture (Hardware/Software)

Figure 1 illustrates the major functional components of the Power Play product prototype. The Old Dominion University virtual machine will be the web server and house the MongoDB databases for the product. The website user interface will be written with Python, AJAX, PHP and Javascript. The database will hold account information, player data, gameplay results, and be accessed via the front-end.

4.2 Prototype Features and Capabilities

Table 1 contains the primary goals of our prototype, which is demonstrating the front-end functionality of Power Play. Features such as plant retirement, refurbishment, construction, environmental impact, account creation, creating scenarios and viewing results will all be present.

Feature comparison between full product and prototype

<table>
<thead>
<tr>
<th>Features</th>
<th>RWP</th>
<th>Prototype</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Player Features</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant retirement</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Plant refurbishment</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Plant construction</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Viewable resources</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Viewable Environmental Impact</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Viewable Earnings</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td><strong>Administrative Features</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create game scenarios</td>
<td>✔</td>
<td>✔ &lt;sup&gt;partially implemented&lt;/sup&gt;</td>
</tr>
<tr>
<td>Create and remove player accounts</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Reset collected data</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Access player game results</td>
<td>✔</td>
<td>✔ &lt;sup&gt;partially implemented&lt;/sup&gt;</td>
</tr>
<tr>
<td>Player update notification</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Analysis Features</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>Viewable decision data</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Viewable event collection data</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Viewable data collection by type</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Downloadable data by region</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Downloadable data by date</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Testing</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant retirement test</td>
<td>✗</td>
</tr>
<tr>
<td>Plant refurbishment test</td>
<td>✗</td>
</tr>
<tr>
<td>Plant construction test</td>
<td>✗</td>
</tr>
<tr>
<td>Viewable resources test</td>
<td>✗</td>
</tr>
<tr>
<td>Viewable environmental impact test</td>
<td>✗</td>
</tr>
<tr>
<td>Viewable earnings test</td>
<td>✗</td>
</tr>
<tr>
<td>Create game scenarios test</td>
<td>✗</td>
</tr>
<tr>
<td>Create and remove player accounts test</td>
<td>✗</td>
</tr>
<tr>
<td>Reset collected data test</td>
<td>✗</td>
</tr>
<tr>
<td>Access player game results test</td>
<td>✗</td>
</tr>
<tr>
<td>Player update notification test</td>
<td>✗</td>
</tr>
</tbody>
</table>

Table 1. Feature comparison between real-world product and prototype.

4.3 Prototype Development Challenges

There are multiple challenges that are expected while completing the prototype. One of these challenges is integration with the Spark! simulation engine. As this simulation engine is not being developed by this team, it could prove difficult to coordinate team black's efforts with that of the researchers to ensure that the front-end and back-end are compatible. Also, integration with the Google Maps api can be problematic in part due to the first issue of not being the development team creating Spark!. These are both issues that will become more clear as we move through the project. The amount of time available for this project, one semester, can
also be challenging as well as the technical ability of the team. These go hand in hand as the time constraint is directly related to the team's programming ability.
Glossary

**AJAX:** AJAX stands for Asynchronous JavaScript and XML. AJAX is a new technique for creating better, faster, and more interactive web applications with the help of XML, HTML, CSS, and Java Script. Ajax uses XHTML for content, CSS for presentation, along with Document Object Model and JavaScript for dynamic content display.

**Flask:** Flask is a microframework for Python based on Werkzeug and Jinja 2.

**Javascript:** an object-oriented computer programming language commonly used to create interactive effects within web browsers.

**MongoDB:** MongoDB is an open source, document-oriented database designed with both scalability and developer agility in mind. Instead of storing your data in tables and rows as you would with a relational database, in MongoDB you store JSON-like documents with dynamic schemas.

**PHP:** PHP is a widely-used open source general-purpose scripting language that is especially suited for web development and can be embedded into HTML.

**Python:** Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python’s simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms, and can be freely distributed.
**Spark Simulation Engine:** Spark Simulation Engine is a system being created to model and simulate different power distribution scenarios and events. This will provide the back end to the Power Play Project.
References


