# Project Troll

# New Mexico Supercomputing Challenge

# Final Report

# April 2, 2012

# Team 50

# Grants High School

Team members:
Nicholas Kemp
Devin Lowther
Jacob Alford
Tanner Bond

Teacher:
Samuel Daunt

Project Mentor:
Peter Yanke

# Table of Contents

# Executive Summary

Project Troll is a mobile application (app) written in Xcode for mobile devices that run on Apple's iOS. This app is intended for use in civil engineering and bridge building projects. This app will provide engineers in the field access to technical calculations and visualization on their handheld devices, helping them develop basic structural components of the bridge. The app will allow users to choose the type of bridge he or she needs, the raw materials required for that chosen bridge (i.e., wood, metal, concrete), and specify the length of the bridge. Once the user inputs these choices into the app, it will calculate the approximate cost of the bridge. In order to calculate bridge's cost, the app will calculate the cost per foot of these raw materials using existing bridges and their known overall costs; needless to say, the app will calculate *estimated* cost. Since this app will present the raw materials choices as on/off switches, users can select one or several raw materials for their bridges. The app's user interface allows users to use a "pinch" method to change the length of the bridge. First, the user chooses which type of bridge him or her wants (i.e., suspension, arch, beam, or cantilever). Then he or she chooses the desired raw materials by flipping the appropriate switches to "on." Then a screen will appear with a picture of the chosen bridge. After that the user can pinch the screen with two of his or her digits to make the bridge longer or shorter. Using a 15-inch Apple MacBook Pro, we wrote the app using the most recent version of Apple's Xcode, version 4.2. Once we have developed this app into a more commercially viable product, we will make it available on the Apple App Store.

# Report

## Introduction

*Project Troll* is an app that runs on Apple iOS devices. This app provides civil engineers in the field with a starting point for building new bridges. Once an engineer downloads *Project Troll* onto his or her mobile device he or she can use it as a quick reference for determining the cost of a planned bridge. Normally, when engineers are in the field, scoping out locations for new bridges, they do not have access to a quick, easy reference for determining the cost of a new bridge based on its raw materials. In order to solve this problem, we designed this easily accessible app that performs these essential functions. However, our app is not the first app that performs such functions. Google Play (Android Market) and the Apple App Store sell ten apps that resemble ours: *Engineering Pro, RealCalc, 4-in-1 Mechanical Engineering, Engineering Libraries, Engineering Jobs, Engineering Unit Converter, Engineering News, Civil Engineering Formulator, AndTruss2D,* and *Engineering Dictionary* (Goel). Four of these ten apps are sold on Apple's App Store and do the same basic function as our app.

## Methods and Materials

Using Apple's Xcode 4.2 and an Apple MacBook Pro, we designed the *Project Troll* app that solves this accessibility and calculation problem for engineers. Andrew Stone, a professional Xcode writer and app developer helped us learn how to use Xcode to perform the functions of the app. In addition, we consulted with our team sponsor and local engineer, Peter Yanke, regarding the basic structural components of bridges. We used Xcode's basic user interface to write and refine the code for the *Project Troll* app.

We set up the user interface of our app in such a way that users employ a "pinch" method to manipulate the length of their desired bridges. In order to achieve this "pinch" method, a portion of the code detects when a user inputs two fingers either sliding toward or away from each other on the touch screen. This resizes the bridge and tells the user how long the bridge is. When a user first starts the app, he or she chooses which bridge to build (i.e., suspension, truss, cantilever, beam, or arch). After that, an image of the desired bridge is appears for the user to see. Then he or she can choose the raw materials needed (i.e. wood, metal, and/or concrete) by flipping each of the three "switches" to the "on" or "off" positions. When a switch is flipped to the "on" position, the app will include one of the raw materials in the cost structure of the bridge. The user can turn one, two, or all three switches to the "on" position for a particular bridge. After the user inputs the bridge type, length, and raw materials, the app will display the output—approximate cost.

In addition to the setting the bridge's length, using the "pinch" method, and choosing raw materials, the app will also utilize a small, simple data base. This database will contain and provide specific information about certain bridges, presented as model bridge "profiles." This component of the app will provide the user with a simple reference tool to learn about existing bridges.

## Results

As a result, *Project Troll* is a stable engineering application that provides users with the approximate cost of a new, planned bridge based on the bridge type, its raw materials, and its length. Users can pinch their fingers on scaled diagrams that display the length of their planned bridges. Switches on the bottom of the user-interface enable users to specify the bridges' raw

materials and, in turn, tell the application whether the bridge will be made of metal (i.e. steel and/or iron), concrete, or wood. The approximate costs of different bridges will change based on which raw materials the user has chosen and based on the bridges' specified lengths. The app measures the costs of raw materials by calculating an average of existing bridges that utilize these different raw materials.

This app's simple user-interface and underlying functions equip any engineer or engineering student with an easy tool to approximate the cost of a new bridge, wherever he or she may be. This can save civil engineers some time determining these calculations.

## Conclusions

This easy to use mobile application will be accessible to a wide range of people all over the world, especially engineering professionals and students. Since iOS is the operating system and powers the most popular mobile devices, this app virtually eliminates the problem of incompatibility. Since this app employs an easy user-interface, users do not have to learn a new program in order to use the app. The stability of this app and iOS means that engineers can rely on a stable app when working in the field. Since we are still editing and touching up the code, we will continue working on fine tuning the code that runs this app between now and the Final Expo and Awards Ceremony, ensuring that the app does not crash and runs as smoothly as possible.

# Acknowledgments

Team 50 of Grants High School in Grants, New Mexico would like to thank the following people: Samuel Daunt, Peter Yanke, Andrew Stone, and the Supercomputing challenge officials.

Samuel Daunt, our advisor, was a great help during both good and bad times while working on this project. He supported us when we had problems with teammates, problems with the project, and time management problems. He was great at letting us discuss with each other and make decisions that benefitted the team as a whole.

Peter Yanke, our sponsor, gave our team direction when it needed it most. He helped with the understanding of bridges and civil engineering. He was a great sponsor.

Andrew Stone, our Xcode consultant, was a huge help with understanding Xcode. Without him, the code for this app could not have even been written. To have an expert help us with this complex code is greatly appreciated. The fact that he took time out of his life to help high school students is really amazing.

Lastly, we would like to thank everyone with the NM Supercomputing Challenge for letting Grants High School participate in their first ever Supercomputing Challenge. We look forward to seeing everyone at the Final Expo and Awards Ceremony.

## References

Goel, Tarun. *10 Best Apps for Student Engineers*. Ed. Lamar Stonecypher. 8 August 2011. WWW. 4 April 2012. <http://www.brighthub.com/engineering/mechanical/articles/122757.aspx>.