FALL 2021 – COS 397 COMPUTER SCIENCE CAPSTONE PROJECT PROPOSAL

Project Title: Geospatial Data Portal

Submitted By: Blue Marble Geographics

Brief Description

Blue Marble Geographics has interest in development of a dynamic web portal that can be used to organize and manage large quantities of geospatial data. This portal will need to handle raster-based imagery (TIFF, JPEG, DEM, etc), vector-based GIS data (SHP, KML), point-cloud and lidar (LAZ, LAS), and provide an interface to Cloud based data architectures (AWS, Azure, Google Cloud). Users will have shared and private dataset privileges and will be able to visualize basic information and metadata attached to each working set. This metadata may include EXIF tags, Coordinate Reference system information, basic geographic location, as well as general format details.

The Primary components for this project will be:

1) Administrative Interface. This component will be responsible for tracking individual users, assigning roles, and granting access to various portions of the web service. It should also contain all management type information (disk usage, user details, site maintenance and performance information, etc.) required to manage and maintain the system. It will need to be designed with security in mind and should use a generic authentication technology for the portal service. There should be several access levels available including a generic user and a site administrator, with varying roles and permissions. User level and site level administrative reporting capabilities should also be included in this interface.

2) User Data Interface. This interface will be used for visualization and storage of all geospatial data. A user will be able to upload, download, organize, and visualize all data using this collection of pages. This interface should support general file system type operations, including directory management along with data ordering and sorting capabilities, and project-based workflow design templates. The interface should include a basic map component that will demonstrate geographic locations for any contained data. The interface should also contain a more detailed viewer which will render map data as single layers, or in a collection. Additional reporting capabilities by region, project, and datatypes should also be extended to the user.

3) Data Access portal. Users should be able to extend local scripting processes that will be able to access data stored on the portal service. These scripts will initially use Python and a limited set of extension libraries. An additional interface will provide access to a Blue Marble Geographics R&D instanced server for analyzing and characterizing specific raster data. This process and interface will need to be scoped and designed by the development team with input from BMG principals.

The development team should take advantage of 3rd Party software projects as necessary. Various open-source options exist that can be used for authentication services, data read, visualization and mapping. In addition, Blue Marble Geographics has expert area knowledge in geospatial development, analysis, and design. Team members will have access to this knowledge and should feel free to speak with us.

Goals for the project

This project should be focused on providing a positive customer experience for users managing, displaying, and analyzing their geospatial data. The team should focus on clean and concise development practices that will provide for future expansion of this application.

Total Duration / Elapsed Time [in weeks]: ~24 weeks

External Schedules / Deadlines [if any]: None

Learning Objectives for student teams:

Students should:
- Use best practice software development and design strategies
- Learn general web security principles
- Become familiar with specialized data formats (geospatial data)
- Learn to access and integrate 3rd Party software development tools
- Work with a dynamic design team, and subject matter experts

Expected Project Experiences (select from the list):

Problem definition
Project scope definition
Data analysis
Workflow analysis
Development of functional specifications
Identification of and negotiation for needed project resources
Examination of an unfamiliar technical area Identification of
others' technical expertise Identification and evaluation of
alternatives Development and presentation of
recommendations Responsibility and accountability for a
discrete product
Role definition in a task group and participation in group dynamics Observation
of supervisory activities (e.g., personnel assignment, training, development of
procedural guidelines)
Observation of management styles Observation
of organizational politics

Recommended experience (What operating system is required? What programming language? Other skills?):

This project is focused on web development. Linux or Windows are acceptable platforms. Primary UI design should take advantage of a modern programming language or framework. A basic Python scripting interface will be required for the Data Access Portal, but no other language support is required.

Several 3rd Party libraries may come in handy for this project. These include Open Source geospatial tools such as the GDAL library set (https://www.osgeo.org/projects/gdal/), potree opensource point cloud viewer

(https://github.com/potree/potree) , MapServer WMS spatial data viewer service (https://www.osgeo.org/projects/mapserver/), and the OpenLayers toolkit (https://www.osgeo.org/projects/openlayers/). In addition, Blue Marble will make available their own proprietary SDKs if the team chooses to extend their specific technology.

Expected Outputs/Products and likely requirements (specific programming language, operating system, integration with existing software, web-based requirements, *etc.*):

The deliverable for this project should be a hostable web application. Containerization (Docker, or some other technology) would be a suitable means of deployment, but not required. Performance of the service, including visualization, should be a key metric for the final product. Version control systems should be used and shared with the BMG team (if practical). Since this project may be commercialized, considerations should be made when selecting 3rd Party software tools with regards to licensing restrictions.

Past experiences by the client (If software already exists, what is wrong? What has worked in previous versions, and what has not?):

In the past, Blue Marble Geographics provided a desktop product called the Geographic Explorer which allowed users to organize and visualize data. This product was not designed for a web and cloud-based architecture. We have also developed Web Mapping products, such as our Beyond Geo tools, but have never really made the leap to a fully cloud based data project.

Proposed Testing Plan (How will the team test their product? Do you have recommended/required testing strategies? What resources are available (test platform, stand-alone network, *etc.*)? Is test data available?):

- Each visual component of the application should have a clear set if interface design documents that can be manually verified by the development team and Blue Marble Geographics.
- Blue Marble will provide the team with a collection of all required test data types and expected metadata parameters.
- Blue Marble will provide licenses for Global Mapper desktop software. This can be used to validate data visualization and geographic location.
- Blue Marble will provide test python scripts that can be used to validate the Data Access Component interface

In addition, virtual or cloud-based machine instances can be provided to host prototype and final project components.

Benefits to U Maine:

Besides the obvious learning opportunity presented to the students involved in this project, Blue Marble Geographics feels that the field of geospatial data collection and analysis is a very fertile market. The challenges presented by these data and processing toolchains are dominant issues in the present and will only expand in the future. As real-time sensor technologies such as lidar, and drone-based photogrammetry systems enter the marketspace at consumer level prices, opportunities for technological innovation and growth will increase exponentially. As a leader in technologically innovate product design and development in the State of Maine, UMO is uniquely positioned to take advantage of this exciting marketspace.

Project Sponsor(s):

Blue Marble Geographics:

Patrick Cunningham, CEO
Victor Minor, CTO
Sam Knight, Director of Product Management

Other Resource People:

Stephanie Martini, Director of Quality Assurance
Katrina Schwikert, Product Manager
Jeffrey Hatzel, Product Manager

Software/server access required:

No specific software or server access is required.