**Project Statement of Work**

**Collaborative Solar Image Annotation**

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# Executive Summary

Our sun is the lifeblood of our solar system. It provides the energy and light we use every day to grow our crops, power solar devices, and illuminate our daily lives. But there is a dark side to the sun. Coronal mass ejections, giant expulsions of plasma and magnetic fields emitted from the sun, pose a very serious threat to our power grid and national security. A large enough ejection can shut down power on a mass scale, disrupt navigation, and leave the country vulnerable to military threats. Obviously, there is a vested interesting in predicting these coronal mass ejections to take the appropriate countermeasures.

This is the goal of the Collaborative Solar Annotation Project. With the help of Dr. Marios Pattichis, our objective is to create an open-source web application that will collect manual annotation of coronal holes. Users will be able to upload images to the database and annotate the uploaded pictures using integrated design tools. The data points collected will allow researchers to better understand the characteristics that signal the mass ejections.

The features for this web application include:

• Open-source database architecture

• Secure multi-user account interface

• Communication tools for collaborative efforts

• Capacity to combine several annotation files into one

• Normalized coordinate system

• Exporting of data

The astronomical field is in need of this type of collaborative technology. With the help of this solar annotation application, scientists will have the capacity to exchange ideas and better understand the dynamics of the sun that lead to these coronal mass ejections.

# Business Need

Dr. Marios Pattichis is sponsoring the development of the Solar Image Annotation web application at through the ECE Department at the University of New Mexico. This project comes as a response to the growing need and awareness of solar weather and the effects it can have on our critical electronics in space and here at home. Currently, a Linux application exists that allows users to annotate and markup solar images, saving the coordinates, but there is a lot of room for this to grow. Dr. Pattichis believes the best way for this program to progress would be to have it reside in a web-environment, where many users can annotate images in a collaborative environment. This program will allow users to upload solar images, annotate the image using integrated tools, and store their works on a secure MySQL database for easy access.

The United States, as well as other first world countries, have had satellites in space for decades now. Today, more and more countries are deploying satellites into orbit. All of this technology going around our planet is very vulnerable to damage by solar flares and coronal mass ejections. With many eyes watching the sun, we have a greater chance of detecting harmful solar weather. One day, when a big solar flare explodes off the surface of the sun, we might just have enough time to power down and protect some of our critical electronics, which would save billions of dollars worldwide. The Collaborative Solar Image Annotation web application will give us that chance.

# Product Scope Description

The Collaborative Solar Image Annotation Project has been approved to design, develop, and prepare for deployment the Collaboration Solar Image Annotation product. Dr. Marios Pattichis in conjunction with the AFRL Space Weather Center of Excellence view this product as a movement from the limited prototype to an open-source software platform with a web based GUI featuring collaborative capabilities. The product is expected to enhance the study of coronal holes and space weather science by fusing the products manually annotated digital image data points with automated analysis tools in development. The scope of the Collaborative Solar Image Annotation product consists of the following characteristics:

Features:

* Open-source web server based utilizing PHP, MySQL, JavaScript, HTML and CSS
* Multi-Platform deployable and verified working on ECE server
* Secure multi-user hierarchal account interface
* Users pull images independently from internet
* Store point & click annotations in each images normalized coordinate system
* Annotation data stored and available in SDO/AFRL compliant format
* Track each users annotations to specific images
* Each users annotations per image can be combined into one image by administrator
* Communication capability between users with administrator moderator
* Administrator can lead collaborative effort to evaluate combined images in consensus

# Project Scope Description

|  |  |  |  |
| --- | --- | --- | --- |
| Task | Start | End | Duration (Weeks) |
| SOW | 9/24/2014 | 10/8/2014 | 2.00 |
| Project Approval | 10/8/2014 | 10/13/2014 | 0.71 |
| Project Work Begins | 10/15/2014 |  |  |
| **Work** | 10/15/2014 | 11/3/2014 | 2.71 |
| Review programming languages & their capabilities |  |  |  |
| Research similar websites |  |  |  |
| Determine functionality & capabilities |  |  |  |
| Team Presentations to Sponsor | 11/5/2014 | 11/19/2014 | 2.00 |
| Functional Specifications | 11/5/2014 | 11/24/2014 | 2.71 |
| **Work** | 11/4/2014 | 12/3/2014 | 4.14 |
| Make working server |  |  |  |
| -- make sure all team members have access |  |  |  |
| Work on database design & setup |  |  |  |
| --continue working on database |  |  |  |
| Winter Break | 12/4/2014 | 1/21/2015 | 6.86 |
| **Work** | 1/22/2015 | 2/16/2015 | 3.57 |
| --continue working on database |  |  |  |
| Create prototype & Work on Test plan |  |  |  |
| Work on canvas design & setup |  |  |  |
| --continue working on interface |  |  |  |
| Test Plan | 2/2/2015 | 2/16/2015 | 2.00 |
| **Work** | 2/17/2015 | 3/7/2015 | 2.57 |
| Work on functionality of website |  |  |  |
| Spring Break | 3/8/2015 | 3/15/2015 | 1.00 |
| **Work** | 3/16/2015 | 4/13/2015 | 4.00 |
| Work on characterization report |  |  |  |
| Testing |  |  |  |
| --functionality |  |  |  |
| --different browsers |  |  |  |
| Characterization Report | 3/16/2015 | 3/30/2015 | 2.00 |
| Project Work Stops (Student Project Reviews) |  | 4/13/2015 |  |
| Posters | 4/8/2015 | 4/20/2015 | 1.71 |
| Poster Section | 5/1/2015 | 5/1/2015 | 0.00 |
| Final Report Project Notebooks | 4/13/2015 | 5/1/2015 | 2.57 |
| **Total time for work (excluding winter/spring break)** | **10/15/2014** | **4/13/2015** | **26** |

# Sponsor Support Elements

|  |  |  |
| --- | --- | --- |
| **Sponsor Support Elements** | | |
| **Element** | **First Needed** | **Needed Until** |
| *Learning PHP, MySQL, JavaScript & CSS* | 9/22/14 | .. |
| Canvas software | 10/6/14 | ... |
| Technical advisement (can simply be email or other on- line communication) | 10/6/14 | 4/29/14 |
| ECE department computer for setting up our server | 3/1/14 | ... |
| Approval of poster for public display | 4/29/14 | ... |

# Approvals

The signatures of the people below indicate an understanding in the purpose and content of this document by those signing it. By signing this document you indicate that you approve of the proposed project outlined in this Statement of Work and that the next steps may be taken to create a Requirements Document and proceed with the project.

|  |  |  |  |
| --- | --- | --- | --- |
| **Approver Name** | **Title** | **Signature** | **Date** |
| Dr. Marios Pattichis | Sponsor |  |  |
| Patrick Lopez | Technical Mentor |  |  |
| Dr. Marios Pattichis | Project Manager |  |  |
| Dr. Daryl O. Lee | Instructor |  |  |