**Functional Specification**

**Collaborative Solar Image Annotation**

**Project Manager: Patrick Michael lopez**

**Connor Ryan Dolan**

**Edward Sadzewicz**

**Cody Wayne Shell**

**Jaclynn Javonna Wakley**

**University of New Mexico**

**School of Engineering**

**PROFESSOR MARIOS S. PATTICHIS Dept. of ECE, UNM**

**Department of Electrical & Computer Engineering**

**MSC01 1100**

**1 University of New Mexico**

**ECE Bldg., Room 125**

**Albuquerque, NM 87131-0001**

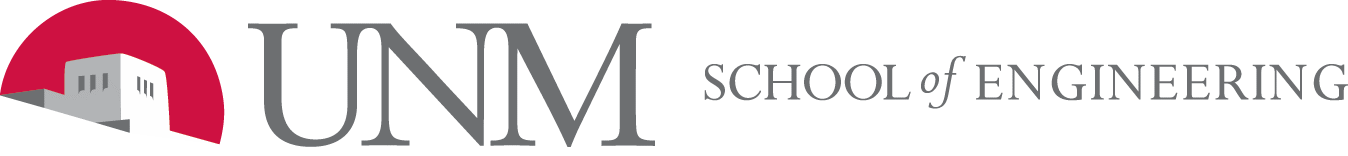
**and**

**AFRL SPACE WEATHER CENTER OF EXCELLENCE**

**3550 Aberdeen Ave., SE**

**Kirtland AFB, New Mexico 87117**

**26-NOV-2014**



|  |  |  |  |
| --- | --- | --- | --- |
| **REVISION HISTORY** | | | |
| **Name** | **Date** | **Changes** | **Version** |
| Connor Dolan | 24/Nove/2014 |  | 1 |
|  |  |  |  |
|  |  |  |  |

Table of Contents

Table of Contents 2

**Introduction** 3

2.1 Summary 3

2.2 Requirements 3

2.3 Numbers 3

2.4 Existing System 3

2.5 Terminology 4

2.6 References 4

**Functional Description** 4

3.1 Use Cases 4

3.2 User Community 4

3.3 Administration Functions 5

3.4 Error Handling 5

3.5 Security 5

3.6 Help 5

3.7 Printing 5

3.8 Interfaces 5

3.8.1 User 5

3.8.2 Software 5

3.8.3 Hardware 6

3.8.4 Mechanical 6

3.9 Boundary Conditions 6

3.10 Constraints 6

3.11 Platforms 6

3.12 Internationalization 6

3.13 Performance 7

Performance will largely depend on the eventual size of the server. See [1] for more. 7

3.14 Portability 7

3.15 Expandability 7

3.16 Customization 7

3.17 Support & Maintenance 7

3.18 Configuration Management 7

3.19 Documentation 8

**Approvals** 8

# **Introduction**

The Collaborative Solar Imaging Annotation project (CARINA) is an internet application that will allow collaborative annotation of solar images. This is meant to help scientists collectively search for anomalies on the sun that may indicate solar flares or coronal mass ejections.

## Summary

The goal of CARINA is to create an open-source internet-based application that allows users to upload images where they can be annotated by other users. These annotations will be stored in a database so that researchers can keep track of where more popular locations on the image are.

The intended customer base of this product is scientists and researchers, but as far as making annotations go, more is better, so the application should be made to be easy and accessible for everybody.

This version of CARINA is also meant to be improved upon; it has yet to go through beta testing and has a lot of capabilities and functions that could be added.

## Requirements

*See [1] –Sec 3.*

## Numbers

The number of users using this software at any given time should be around ~100 as an optimistic guess. Minimum size of the database will largely depend on the number of active users on the site, and the size of the server. The ECE Server should be able to support ~1000, users at any time, while a Raspberry Pi can maybe support ~20.

The

## Existing System

Historically research on coronal mass ejections from the sun has been done simply by observing images. On 25/Oct/2006, NASA launched STEREO, two satellites orbiting around the sun but with a large enough distance between each other to give us stereoscopic imagesof solar activity.

These images are currently being analysed using a similar existing Linux application, but with less functionality and collaborative tools than our product intends on implementing.

## Terminology

AFRL -- Air Force Research Laboratory

AIA -- Atmospheric Imaging Assembly

CARINA -- CollAboRative Image aNnotAtion

CentOS -- Community Enterprise Operating System

CSS -- Cascading Style Sheets

CSV Comma Separated Values

FITS -- Flexible Image Transport System

GPS -- Global Positioning System

GUI -- Graphical User Interface

HMI -- Helioseismic and Magnetic Imager

HTML -- Hypertext Markup Language

HTML5 -- Hypertext Markup Language Version 5

HTTP -- Hypertext Transfer Protocol

HTTPS -- Hypertext Transfer Protocol Secure

JSON -- JavaScript Object Notation

LAMP -- Linux, the Apache HTTP Server, the MySQL

MySQL -- My Structured Query Language

NASA -- National Aeronautics and Space Administration

PHP – PHP: Hypertext Processor with Personal Home Pageas recursive “backronym”

PNG -- Portable Network Graphics

RSA -- Ron Rivest, Adi Shamir and Leonard Adleman

SDO -- Solar Dynamics Observatory

UNM -- University of New Mexico

XML -- Extensible Markup Language

## References

Sadzewicz-SRS[1]

SOW[2]

# **Functional Description**

## Use Cases

The web-app will be able to accept images that are uploaded by users and store them in a gallery. Users can annotate these images and the annotations will be stored in a database. This creates an environment that facilitates collaborative work on observing solar phenomena.

## User Community

The users of this application will come in two groups with significant overlap. One group is those who annotate images, and the other is scientists who use these annotations for research. The first group will consist of a mix of scientists and enthusiasts, while the second group will be strictly scientists.

Non-users will be able to observe the images and browse the site but will not be permitted to make annotations.

## Administration Functions

Administrators will be able to remove images and annotations, as well as ban uncooperative users. Administrator will also be able to view all user annotations, with the ability to download and this export data.

## Error Handling

When an error occurs, users will be notified with an error message, and a log will be updated to include the error. The error log will help with debugging persistent errors.

## Security

Users will log in with a user name and password that are held in a MySQL database. Passwords will be protected using the security features in MySQL and following their recommended design specifications.

## Help

The site will include a help page that will have an FAQ and give instructions on how to perform various tasks.

## Printing

N/A

## Interfaces

### User

The user will interact with the product through a GUI written in JavaScript and CSS.

### Software

Our project will use Apache to run the web server , MySQL to create a database , PHP to interface MySQL with running scripts, HTML as our mark-up language, and finally JavaScript and CSS as graphical front ends.

### Hardware

The local ECE Server will run the finished product.

### Mechanical

N/A

## Boundary Conditions

A minimum resolution and maximum resolution for images uploaded to the sight will ensure a standard of quality while staying efficient in terms of amount of data stored.

## Constraints

Images uploaded from NASA’s SDO site are not copyrighted and are available to the general public. Users will be subject to a terms and conditions stating that all uploaded images become property of the general public.

A visitor to the site may view but not modify or collaborate with other analysts or participate in forums unless they have established a user account and successfully logged into the application.

## Platforms

The web app will be easily deployed and ran on open-source platforms, i.e. the web app will not need proprietary software in order to function properly. The application will be compatible with most modern, relatively up-to-date web browsers (Chrome, Firefox, Safari, and Internet Explorer). Accurate retrieval of solar images needed for annotation will depend on NASA's SDO website.

## Internationalization

International use should be available from the beginning. This is a free, open-source product, and international law protects such collaborative projects.

## Performance

### Performance will largely depend on the eventual size of the server. See [1] for more.

## Portability

As previously stated, Mac OS X, Windows and Linux distributions will be compatible. The minimum functionality for web-browsers includes just FireFox and Chrome, but Internet Explorer and Safari support are

## Expandability

The product will be made with the expectation of future expansions kept in mind. This means making flexible and well documented code so that future features will be easy to implement.

This will be achieved

## Customization

The application will be open-source, but customization will not be a useful feature to facilitate the goal of this project.

## Support & Maintenance

Administrators may remove poor-quality or irrelevant images from the site as well as bad annotations.

An error log will be kept to find bugs or common problems on the site. Action will be taken accordingly to fix these issues.

## Configuration Management

The CARINA webapp delivery consists of software in its entirety and will be under configuration management (CM) practices throughout the development phase and after delivery. The engineers each have a private developer baseline maintained in a cloud based open source software repository accessible by their development computers. A master baseline will be maintained in the same repository throughout development and delivery. The engineering repositories and the master will have unique password protected accounts resulting in a separation of the developers and delivery repositories.

A revision history archive is included with the master repository due to the common design nature of software repository versioning systems. Each file component that comprises the webapp as a whole will be tracked with its version specification each time the master baseline is updated and is assigned its own master version specification. All changes between file versions will be accessible for traceability. A baseline will be archived during each milestone of the testing phases thru delivery in the master baseline.

A post-delivery repository will be established per the sponsor’s preferences.

Various versions of our program will be managed through a GitHub repository.

## Documentation

A help section will be included on the site providing instructions for use. There will also be a forum for answering specific questions.

# **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 Functional Specification and that the next steps may be taken to proceed with the project.

|  |  |  |  |
| --- | --- | --- | --- |
| **Approver Name** | **Title** | **Signature** | **Date** |
| Mario Pattichis | Sponsor |  |  |
| Mario Pattichis | Technical Mentor |  |  |
| Patrick Lopez | Project Manager |  |  |
| Rich Compeau | Instructor |  |  |