**Red Team**

**Stargazer**

**Automatic Telescope Control System**

**Vision**

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**Course:**

**COSC 471**

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# ****Revision History****

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| **Date** | **Version** | **Description** | **Author** |
| 10/16/2009 | 1.0 | Document created. | Robert, Rob, Jason |
| 10/28/2009 | 1.1 | Small changes are made. Customer names have been added. | Robert, Rob |
| 11/29/2009 | 1.2 | Small changes made. | Rob |
| 1/28/2010 | 1.3 | Small changes made. | Rob |
| 3/10/2010 | 1.4 | Added digital camera make and model received from college. | Rob |

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# ****Vision****

As the members of Red Team, we are developing an automated telescope control system for our customer contacts Alexander and Nan (email: [lyuks@hotmail.com](mailto:lyuks@hotmail.com), ICQ: 282432499). As part of the development team, he will have the responsibilities of coming up with user stories and testing of the system (using acceptance tests). Youry will help and act as a mediator between us and our contact.

The client currently uses manual telescopic positioning and wishes to make the process automated. Our responsibility will be to develop such a system that will automatically position the telescope according to user input. After the user has entered telescope positioning inputs into the system, it will call an application on the server connected to the telescope to move the telescope to that location and start photographing pieces of the sky and will process the images in order to assemble them together to create a higher resolution image.

If new unidentified objects in that part of the sky are found, then the operator should be notified via email. The application should give an option to store such pictures into special folders either automatically or manually.

Other functionality that will be implemented is some ability for mobile devices to access the system.

The system should be extremely reliable and dependable.

#### Purpose:

This system will help the customer scan the night sky to identify new objects by automatically positioning the telescope and capturing pictures over time. These pictures will then be automatically analyzed to identify potentially interesting new objects.

#### Scope:

This project will include a system for positioning the telescope, capturing images and processing the resulting images. A communication system will be implemented to alert the operator of any interesting objects found. Finally a security system may be needed to ensure that only authorized users can access the system. Some of these systems may already be provided by other sources so our system can interface with these applications.

#### Overview:

The rest of this document contains: the product positioning, the stakeholders for this project, the project features, the functional and non-functional requirements, as well as the design constraints, and the project glossary.

# Business Case

#### Product Description:

The automatic telescope control system to be developed (codenamed Stargazer) is a web system that will automatically position a telescope, schedule it to take images of the selected sky area and process the images to attempt to find new, unidentified objects. As well, if any new objects are found, the system will notify the operator.

Stargazer is being developed in an attempt to alleviate the inefficiencies in manually positioning the telescope and processing the images taken by the camera. Through the automated nature of Stargazer, less time can be spent on menial tasks.

#### Business Context:

The system is being developed for our customers, Alexander and Nan, and they are the chief and only users of the system. As astronomy is a hobby of theirs, they own and operate a powerful telescope and camera in order to pursue their interests. The devices (the telescope and camera) have interfaces which Stargazer will use to control them and automate the processes described earlier.

Only the operators of the telescope will have access to the system. An operator will authenticate oneself through the login subsystem to prevent unauthorized access.

#### Product Objectives:

Automate the processes of:

* Positioning the telescope to a certain location in the sky at a certain time of day.
* Take many photographs of that area and merge them to become a composite, high resolution image.
* Compare the image with previous images of the same area.

Also, if any new, unidentified objects are found, then the system will notify the operator.

The system will authenticate users to prevent unauthorized access.

# Positioning

#### Business Opportunity:

Create a fully automated telescope positioning system with image capture and recognition capabilities.

#### Problem Statement:

|  |  |
| --- | --- |
| The problem of | Manually identifying new objects in the night sky |
| affects | Alexander and Nan |
| The impact of which is | Wasted time and frustration. |
| A successful solution would be | A web system that allows the customer to indicate an area of the sky and then have the system automatically photographs that area and compares the resulting images to older images from that area to identify new objects. |

#### Product Positioning Statement:

|  |  |
| --- | --- |
| For | Alexander and Nan. |
| Who | Requested an automated telescope positioning and image capturing system. |
| Automated Telescope Control System | Is an online web system. |
| That | Allows the operator of the system to input a time, date and area of the sky to the system to automatically position the telescope to those coordinates and then capture and compare the resulting images the telescope photographs to find new unidentified objects. |
| Unlike | The current system, which requires mostly manual operation. |
| Our product | Will be automated, easy to maintain and free to use. |

# Stakeholders

|  |  |  |
| --- | --- | --- |
| **Name** | **Represents** | **Role** |
| Red Team Members | Developers | Designing and developing the system. |
| Youry Khmelevsky | Instructor | Will provide guidance for the project and offer suggestions for improvement of the quality of the software.  Also will be mediator and liaison between the development team and the customer. |
| Alexander and Nan | Client | Main operators of the system and owners of the telescope.  Will provide user stories and perform testing (through acceptance tests) and gives feedback and guidance for the project. |

# Product Features

1. Positioning System; the operator enters necessary information such as time, date, coordinates, exposure so the telescope will automatically position itself to that location at that time.
2. Image Capturing; once positioned properly the camera will capture images of the area of the sky using the specified camera settings specified by the user. Images will be transferred to the web server if they are to be displayed in the web system. The positioning system is then notified to return the telescope to its default position and enter sleep mode.
3. Image Processing; all images for one area of sky are combined into one large image. Then, new objects are attempted to be found by comparing new images with previous images or objects in the celestial library.
4. User login; the operator will login to prevent unauthorized access. Also, there will be authorization levels. Admin accounts can access all functionality of the web system and can manage user accounts. Regular user accounts (non-admins) will only be able to create, delete, and edit their own schedules while only being able to view other schedules and images.

#### Functional Requirements:

1. Password authentication for users.
2. User provides necessary input for telescope positioning.
3. User is emailed if new objects are found.

#### Hardware and Software Used:

1. Telescope: Meade ETX-60AT-TC (received), Meade LX200 (customer’s)
2. Digital camera: Canon 30D (college’s), Sony A900 DSLR (customer’s)
3. Open source framework: Ruby on Rails
4. Presentation: CSS
5. Telescope-controlling machine’s operating system: Windows XP
6. Web server’s operating system: Fedora 11
7. Web server: Apache
8. Database: Oracle 10g XE

#### User Environment:

Users will be able to interact with the system through an internet browser such as Google Chrome, Mozilla Firefox, or Internet Explorer. Also, mobile devices will also be able to connect to the web system in some limited fashion.

#### Hardware Requirements:

1. Oracle 10g XE Database:
   1. 512 MB memory is recommended to run Oracle 10g XE effectively.
   2. 1.5 GB disk space necessary, at the very least.
   3. 200 MHz CPU processor is the minimum requirement.
2. Apache Web Server:
   1. 50 MB free disk space necessary.

# Glossary

|  |  |
| --- | --- |
| **Term** | **Definition** |
| Operator | The person operating the telescope via our web system; may either be a user or an admin account. |
| Stargazer | Internal project name for the automated telescope control system. |