Concept of Operation – Outline

1. Executive Summary

* What is the purpose of this project?
  1. design and implement a telescope autofocuser and image capturer
* What is the problem?
  1. there is a desire to capture images without using a human eye
* What will our product do/proposed solution?
  1. given an apertura newtonian telescope, we will design and implement an autofocuser attachment that will rotate a crayford style focuser until the image is as focused as can be, capture an astronomical image and present a high quality version of the image digitally.
* In summary how will the product accomplish the solution
  1. This product will act in a position of a human with better performance such as
     1. detect a focused image (should we say more accurately than a human?/ not sure)
     2. control the focusing device on the telescope
     3. system will utilize “post-processing” and display an increased quality of the image

2. Introduction

* what is this project and what is it’s purpose, however do not be repetitive with the executive summary

2.1. Background

* The need for focusing in astrophotography
* Focus dependence on outside factors such as temperature
* “need to maintain critical focus for a long period of time”
* users often re-focus their image after every exposure (exposures can last up to ten minutes)”
* “Most deep space objects (DSOs) are impossible to see with the naked eye, even through a telescope. The ones that you can see this way will appear only in black and white. The human eye is not capable of perceiving color at low light intensity (e.g., when it is night, all cats are gray). These same DSOs, however, become visible when many long exposure photographs are stacked on a computer.”

2.2. Overview

* Technically what will this product do
* technically how will it do that
* go over in summary the flow of the product (as in how are the subsystems connected and how do they enable one another to perform the task)
* include figures?

2.3. Referenced Documents and Standards

3. Operating Concept

3.1. Scope (Provide detail on the scope of your proposed project)

* 1st sentence/paragraph should state:

1. What is the product? ✔
2. What is the purpose? ✔

* 2nd sentence/paragraph should describe how the product achieves its purpose ✔
* 3rd sentence/paragraph should briefly explain how the product will be tested ✔
* Closing sentence/paragraph should explain the uniqueness of this product and who it will be benefiting. ✔

3.2. Operational Description and Constraints (Provide detail on how your project will be used)

* State who will be using this product and why ✔
* Briefly explain how the product will work on a technical level ✔
* List constraints

3.3. System Description (Provide a system level description of your proposed system)

* Name of system: [Explain general role of this system]. [State the parts that make up the system]. [Purpose of the sub system parts]. [Explain how the system contributes to the overall product]. [Chaos control (if applicable)]. Include image if possible

1. Telescope ✔
2. Astro analyzer ✔
3. Motors ✔
4. Image capture/processing ✔

3.4. Modes of Operations (Provide detail on the different modes of operation of your proposed system)

* Identify modes of operation ✔
  + automatic
  + …
* State what the user can control in this mode and what the default setting (if no user input) will be✔
* Describe how the product achieves its purpose while in this mode of operation✔

3.5. Users (Provide detail who will be using your system. Provide some user characteristics such as level of training required for installation, use, and who will benefit from your proposed system)

* Identify main users✔
* Identify main reason why they would use this product ✔
* Identify the main benefits for using this product ✔
* Optional: Identify other potential users and benefits ✔

3.6. Support (Provide detail how support would be given to users. User manuals, tech support, etc…)

* Identify forms of support and what that support will contain ✔

4. Scenario(s)

4.1. Deep Space Images Requiring Long Exposures

deeper space images require longer exposure time. Manual refocusing is typically required every 5 to 10 minutes. To avoid the precision and consistency needed in manual refocusing, the telescope autofocuser will aid the user in capturing and focusing long exposure images automatically.

4.2. Low Performance of the Human Eye

Human eye is often not capable of quality optical performance in low intensity light. The autofocusing telescope uses an imager that is capable of capturing these low light images. Will assist users with focusing in low light, and will produce astronomical images that a human eye can not view naturally.

4.3. Offset Temperature Related Contractions

Telescope usage is often utilized during the evening and night where temperatures begin to decrease. Critical components of the telescope such as the optical tube assembly and focuser drawtube will contract due to the lower temperatures. The telescope autofocuser will assist by autofocusing, relieving the user of manually refocusing the telescope to offset the temperature changes.

4.4 Useful for Amateur Astrophotographers

In astrophotography, manual focus is a skill that is learned over time with an abundance of image capturing. Beginners in this field that desire high quality images with minimal experience can use the autofocusing telescope to ensure same quality image capturing as one would being an experienced astrophotographer.

5. Analysis

5.1. Summary of Proposed Improvements

* An imager capable of capturing images in low light intensity
* A mounting system that is capable of attaching to an adventura newtonian telescope without damaging
* A motor assembly that will rotate a crayford focuser with precision to achieve a focused image
* A program that will assist in post processing, in which it will stack multiple captured images into one final image for better quality

5.2. Disadvantages and Limitations

5.3. Alternatives

* A sensor that when perceiving a focused image will signal the user either audibly or visually to stop manually rotating the crayford focuser
* A

5.4. Impact

* Our autofocusing telescope will assist
* Enviornment?
* Society?
* Ethical concerns?

QUESTIONS FOR SPONSOR

* An image remained focus over a long period of time (ie. if we focus the imager then an hour passes, do we need to recalibrate the focuser and take a new image, or should the autofocuser continuously focus and always have the best image available until the user desires to capture?)