Recommendation for software improvements and modifications

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Recommendation for software improvements and modifications.

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## Change Control

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3. SUMMARY
1. INTRODUCTION

GLORIA is about to enter the third year of the project. Most of the core software has already been developed and most of the planned functionality is already- or imminently - available to users. However, there is always space for improvements. This document summarizes suggestions and recommendations for software improvements and modifications which resulted from obtained user feedback as well as from discussions at GLORIA working meetings and within working groups. These recommendations will be used to plan GLORIA software development activities in the third year of the project. We hope to implement most of user requests listed in this document before the end of the project.
2. RECOMMENDATIONS FOR GLORIA PACKAGES

Within the GLORIA project different software packages were developed and different services were offered to users. This includes also specific implementations in GLORIA demonstrator experiments. Below we list recommendations for improvements for subsequent packages, services and experiments.

A. GLORIA User web pages

In year 3, user web page will include all functionalities of the social network described mainly in R.1 and R.2.
- All users will be able to comment and evaluate all the resources of the system (images, experiments, robotic telescopes, etc...)
- Introduction of the economic model with the auction mechanism.
- Representation of karma and relevance indexes of each resource

In the next year, users will see the state of the network. This include:
- The state of each telescope, for example, if a user is executing an experiment on it, or if is closed with a technical problem, etc...
- The statistics of the network, with charts like the defined in R.3, R.4 and R2.
  - Total number of users
  - Percentage of telescope occupancy
  - Number of images generated by experiment or average by users.
  - Number of active users (see Figure 1)

Another important issue is the owner page. Right now, an user of type owner not have an specific page when he can manage the telescope. This will be added in the third year. Its functionalities will be:
- Select the experiments executed in its telescope.
- Define the distribution of hours of the telescope (see R.1)
  - GLORIA public hours
  - Private time to:
    - Interchange with other telescope.
    - To donate to other users selected for its, like special observations of schools or special educational events.
    - To sell to other users.
- Send messages to users throw the communication channels used by GLORIA (twitter, facebook, etc ...). This messages should be relevant information for users like the telescope is temporary closed for maintenance purposes.
- If the telescope allow it, teleoperate it without restrictions, for example, to help a user if he has a problem during the experiment time.

B. GLORIA Support web pages

For the year 3, is not expected to include new features in the web. Only left upload more information and manuals to users, specially for executing experiments.
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C. GLORIA Online Experiments

Year 2 of the project has been very enlightening from the perspective of the core GLORIA services platform. Having originally set out to serve the entire system out of the Liferay environment it has become apparent that faster and more scalable implementations of most GLORIA experiments (and particularly the online experiments) can be achieved through allowing volunteers to write code in whatever fashion they wish (e.g. JavaScript, Ruby, etc) and not constraining them to a WYSIWYG environment like Liferay. This change of direction was a direct result of the GLORIA collaboration and meetings in Malaga and Oxford, where group discussions of the matter have lead to real change and improvement through working as a collaboration.

Creating template experiments as open source repositories is a demonstrated way to grow an online user-base and increase adoption with the community of coders that exists within astronomy particularly. As such the core GLORIA services have been implemented as a RESTful service, built in Java by UPM (principally by Fernando Serena). This improved and more flexible framework allows for far more interpretations of the original GLORIA concept and allows developers to create many more applications based around our system.

The improved GLORIA services framework is functional and operational but requires significant effort to bring up to it’s full potential. Therefore in Year 3 we recommend that much of the WP8 and WP6 efforts be expended in this effort, creating a GLORIA services platform that is as fully-developed as possible.

D. GLORIA Offline Experiments

The research-level, offline demonstrator experiment is the Luize Lightcurve Viewer. It allows users to reconstruct the light curves of stars from archival data stored on Luiza. We have created a custom interface for star selection and one for light curve viewing. A dedicated analysis server also exists for data processing with the Luiza framework.

The star selection page (see Figure 2 and Figure 3) allows the researcher to either select one of several known stars in a bright field, to pin-point on on an optical star map of the region, or to simple type in coordinates (RA, Dec).

Upon selection of star the light curve viewing interface (see Figure 4 and Figure 5) shows a periodogram of the data from the source and allows the user to fold the data on any period, providing custom tools to make this task easier. This interface also features an experimental fast fourier analysis tool (written in JavaScript) to estimate the period of the data based on a least-squares fitting of a wide range of folding periods and precisions. Although this is not working terribly well yet, it is something that can be improved upon in Year 3 of GLORIA and there is much room for careful optimisation of this idea.

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Figure 2: Star selection page (basic view)

Figure 3: Star selection page (map view)
Luiza is capable of a great deal and at present the available web interface version does not use these capabilities to their fullest. Some functions of Luiza are implemented on the analysis server, but not (yet) reflected in the current front-end web interface. Future development of the interface layer is needed to allow user to:

- Select brightness measurements based on their quality. The Luiza light curve reconstruction processor returns an estimated uncertainty of the measurement, based on the comparison with multiple reference stars. Using this estimate, measurements with largest uncertainties, which usually show strong systematic biases, can be removed from the sample resulting in much “cleaner” light curve. More details of this approach are given in the experiment manual.
- Select measurement calibration parameters and reference star catalogue. Currently considered measurements are always calibrated based on the reference stars found in a radius of 1.5 degrees from their position and assuming that the calibration correction can depend linearly on the position. Luiza framework allows to change this behavior, e.g. by changing the matching radius or using different set of reference stars. These options could also be included in the user interface.

![Figure 4](image1.png)
*Figure 4: Screenshot of Lightcurve viewer*

![Figure 5](image2.png)
*Figure 5: Screenshot of Lightcurve viewer with showing estimate in action*

**E. Luiza framework**

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Luiza framework includes all basic functionality which is needed for reduction and analysis of astronomical images. In particular, its recent development was focused on tools used for implementation and running of the research level off-line demonstrator experiment based on Pi of the Sky telescope data. However, for specific applications additional tools (implemented as so called processors within the framework) could still be implemented to extend the framework functionality:

- additional photometry algorithms, including high precision profile photometry
- tools for accessing remote databases from within the analysis program
- tools for creating star catalogue from large image samples
- tools for identifying variable objects and new objects (nova, flare stars) in the image series

3. SUMMARY

Work done in the first two years of the project focused on the development of basic tools needed for starting all GLORIA services and demonstrator experiments. However, due to time and manpower constraints, we had to postpone implementation of some more advanced features. We plan to continue to develop GLORIA software in the third year of the project to offer better services and maximum flexibility to our community.

The further development of the core GLORIA services platform is seen as key to the growth of the community and thus is a focus of much future development.

We also plan to respond to future requests for modifications, which are still expected from GLORIA users and new network participants.

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