THE TEST-BED TELESCOPES PROJECT: ISDEFE SCHEDULER

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ABSTRACT

Within the Space Situational Awareness (SSA) programme of ESA, the Test-Bed Telescopes (TBT) project will procure a validation platform for an autonomous optical observing system in a realistic scenario, comprising two telescopes located in Spain and Australia, to collect representative test data for precursor SSA services. The TBT scheduler will consist of two modules that will allow the autonomous planning of the night, performed by the ISDEFE scheduler, and the control of the real-time response of the system, done by the internal scheduler of the Robotic Telescope System-2 (RTS2). The combination of both systems will achieve the goal of obtaining a fully robotic system.

The Test-Bed Telescopes Project

One of the main goals of the ESA Space Situational Awareness (SSA) programme is to create a European network of observatories to provide the services needed to acquire immediate and precise information regarding objects orbiting Earth. Ground-based optical sensors are the most efficient systems to detect and track faint objects in GEO and MEO regions. Within this context, the “Demonstration Test-Bed for the Remote Control of An Automated Follow-Up Telescope” is a GSTP project whose main purpose is to provide a telescope Test-Bed for the realistic validation of all the developments and operational aspects of autonomous optical systems. Two identical observing systems will be deployed at two different ESA tracking stations, Cebreros and New Norcia, with the intention of being the precursor of the future SSA robotic optical network.

The ISDEFE scheduler is a web application for planning observing nights in optical observatories. Its goal is to provide a friendly interface where users can introduce and store all the sequence of exposures with the corresponding settings, check the viability of the observations in terms of visibility and telescope configuration, and produce a final output readable by the telescope control system. The scheduler was developed under the CESAR project, an educational programme set up at ESAC by ESA, INSA and INTA, whose main purpose is to provide European students with hands-on experience in astronomy through two robotic optical telescopes (among other devices), that are being deployed at Cebreros and Robledo de Chavela tracking stations.

The following activities encapsulating one or more scheduling tasks are already implemented:

• Create a new observing night using the parameters of date, location and observer.
• Visualize the observations scheduled for a night.
• Create a new Observation Block based on the target and instrument.
• Check visibility constraints: Sun, Moon, horizon.
• Calculate the instrument overheads.
• Create a plot with the elevation of the target.
• Delete an observing block.
• Save the observations scheduled.
• Send the readable output to the telescope control system.

The scheduling interface is a web application, thus it possesses clear advantages from the user point of view compared to any other type of implementation, namely, its maintenance, portability (the only requirement is internet/intranet connection) and usage. The application is mainly running at the web server, consuming few resources at the user’s computer (thin-client). It is also independent from the operating system (multiphorm).

The programming architecture follows the Model-View-Controller (MVC) schema, that separates the application data operations from the representation of the information. The Controller manages user’s requests done through the View, triggering actions to the Model and processing its answer to send changes to the view.

The overall SW system is based on four main modules: context, scheduling, processing and HMI. Each module is based on existing software to be tailored according to ESA requirements. Furthermore, the modules must interact among them in order to provide the observatories a high level of automatization.

The planing tool will implement two general observing strategies: SURVEY and FOLLOW-UP both for man-made objects and Near Earth Objects (NEOs). The implementation of the strategies will be tailored to the characteristics of the target population. Additionally, it will also allow the user planning a custom-made observation with the freedom to modify or generate a new strategy in a system where a night plan is defined as a set of individual Observing Blocks (Fig 2). An overview of the scientific goals of the SSA-TBT can be seen below.

The strategy is defined according to the expected combined performance for both systems the upcoming night (weather, sky brightness, object accessibility and priority) and the time allocated for the two main tasks (NEO follow-up and space-debris catalogue updating).

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