Abstract

The Virtual Telescope is a new robotic facility that makes possible for people worldwide to participate in real-time observations of the sky. Complete scientific instruments are made available, matching the needs of researchers, students and amateur astronomers. Instruments are controlled live and in real time by the remote user while qualified assistance is made available from a professional astronomer, to assist and address the observing experience. The project consists of several remote controlled and independent telescopes, including solar scopes for daytime observations. Their diameters range from 40–360 mm. The project and the technology involved are presented here, as well as the peculiar benefits for students and other users.

Introduction

Technology is changing the way we do and communicate astronomy. While telescopes, detectors and the instrumentation involved are making it possible for scientists to push their view out further, both in space and time, science communicators are experiencing new tools to carry these concepts and ideas to a wide public.

As part of this revolution, it is now possible to access and control a remote observing facility through the internet, slewing a telescope that is thousands of kilometres away. While this is a great simplification for astronomers (they can avoid expensive long trips), it also offers a chance for lay people to use state-of-the-art instrumentation to discover the Universe. Schools and students are the primary targets for these remote observatories but a wider audience can definitely enjoy them.

The Virtual Telescope Project is a new remote robotic facility available to anyone with an internet connection. It offers different telescopes and auxiliary instruments for observing the sky, both at day and night and of course in real-time. It also offers complete, live professional assistance to the user, to get the most from the observing experience as described by Masi(2007a). The integration of technology with such a support makes the Virtual Telescope an outstanding case study. Scientists, amateur astronomers, students and curious people can ALL use the Virtual Telescope being confident that they will understand what they are doing and that they will enjoy a satisfying observing experience.
Hardware and technology

The Virtual Telescope Project consists of several telescopes installed in Ceccano, central Italy, about 100 km south of Rome. They are hosted under a roll-off roof observatory and are fully remotely controlled\(^1\).

The main telescope is a Celestron C14 optical tube assembly (355.6 mm in diameter and 3910 mm focal length, but generally used at f/6) installed on a Paramount ME robotic mount, from Software Bisque. At the primary focus a SBIG ST8-XME, high efficiency CCD camera is available, as well as a motorised filter wheel. Filters for standard photometry and colour imaging are available.

The other telescope is a Celestron C11 optical tube (279.4 mm in diameter and 2800 m focal length, but typically used at f/5) and is installed on a robotic New Atlux mount, from Vixen. The imaging instrumentation consists is a SBIG ST8-XME, high efficiency CCD camera equipped with a motorised filter wheel, sporting filters for colour and narrow-band imaging. In the near future this telescope will be upgraded and will become an exact twin of the previous one. A Takahashi

\(^1\) http://www.virtualtelescope.eu
FS102, 102 mm–f/8 Fluorite refractor is also available, together with a Coronado PST H-α solar telescope.

These robotic instruments are accessed via the internet using VNC-like software. While a web interface is under development, the VNC access is the only one offering full control to all the parameters involved in telescope operation. This way, the remote user accesses the servers at the Virtual Telescope and starts running the session. Images can be automatically forwarded to any FTP site or retrieved as soon as they are grabbed. Each unit of the Virtual Telescope is controlled by a software suite available from Software Bisque and consisting of a number of integrated packages handling the telescope, the detectors and the other instruments.

Modus operandi and assistance

The Virtual Telescope offers several single-user options to those willing to access it: real-time observing (with different degrees of assistance), but also a service mode, where observations are handled by the staff on request. Also, monthly live shows are offered, in this case hosting many users at the same time, who assist in a journey driven by the staff and inspired by a specific astrophysical topic. Special shows are offered when unusual astronomical events happen, like comets or near-Earth objects.

The staff provide complete assistance, no matter if the user is a skilled researcher or a group of children discovering the Universe for the first time. The author was told by the users that they really like this, finding the professional assistance a key, winning factor of the project. The goal is to make it possible for users to succeed with their tasks. The assistance can include full support in scheduling, observing, data reduction and interpretation, all this being especially helpful to unskilled people and students.

Discussion and conclusions

Once introduced to the community (September 2006), the Virtual Telescope experienced a great success. It served more than 35,000 images to more than 400 users, mainly unskilled observers: they used the facility only because full support was available within the framework of the project. More than 160,000 unique visitors entered its website. It has contributed to many scientific projects, including the co-discovery of exoplanets and binary asteroids; it has played a central role to identify the nature of a few cataclysmic variable stars. It “broadcast” special events, like the close passage of asteroid 2006 RZ (Oct. 2006) and comet C/2006 M4 (SWAN), shown in Figure 2, and has contributed to many events in science communication (see Masi 2007b).

The Virtual Telescope is popular with the public because it offers advanced instrumentation as well as complete professional, scientific support, making it a unique facility. In the future it will continue to offer its services, while increasing and improving its instrumentation.
Acknowledgements
The Virtual Telescope technology is powered by Software Bisque and Santa Barbara Instrument Group (SBIG).

References

Figure 2 – This image shows Comet C/2006 M4 SWAN, grabbed on 26 October 2006 with the C11-based unit of the Virtual Telescope (more in the article). A satellite trail crossed the field during the exposures.