12th Hel.A.S Conference
Thessaloniki, 28 June - 2 July, 2015
CONTRIBUTED POSTER

The robotic and remotely controlled telescope at the University of Athens Observatory

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Abstract: A fully automatic remote telescope and dome control system has been installed at the University of Athens Observatory in August 2012. It was constructed in the Laboratory of Astronomy and Applied Optics of the department and incorporated the already existing automation for observations and data gathering techniques. The system proved to be reliable and functions faultlessly up to date, enabling the astronomers to observe remotely from any place, using the network. The observing nights have been increased significantly after the first year of remote operation, reaching the number of 280 observing nights per year (77% annual usage), half of which are characterized as photometric nights of highest quality. This utility favours long-term monitoring projects of blazars and long periodic variables in general.

1 Introduction

Stellar photometry is an essential tool in observational astrophysics, where small telescopes still have major contribution. This is a result of the ability of small telescopes to be occupied on long-term monitoring projects of stellar variables in general. The University of Athens Observatory serves the Physics Department since January 2000. Several research and educational projects have been conducted, including photometric and spectroscopic observations of variable stars and extragalactic objects, as well as educational events for students and public. Stellar photometry is a key method for retrieving information from celestial objects. In various cases long photometric runs are necessary in order to follow long-term light variations, which are interrupted by daytime. On the other hand, long occupation of a telescope for a single target is not the optimum use of a large facility. Continuous observations every night are not always easy to occur, either due to weather conditions or unavailability of the observers. The Observatory hosts a 0.4 m f/8 Cassegrain telescope and belongs to the class of robotic telescopes. Capabilities of this telescope were increased when a remote-controlled mechanism was installed in August 2012, after 12 years of operation. The main computer at the control room could be accessed remotely and almost all functions (CCD camera, telescope and dome) could be controlled. Despite the remote telescope operation there was still a need for the observer to be present while opening and closing the dome. This fact prompted to try the telescope and dome control entirely remotely. The telescope is now fully operational from a distance, and became the first fully robotic and remote controlled telescope belonging to a Greek institute.

2 Design and Construction

Constructions took place in August 2012 in the Laboratory of Astronomy and Applied Optics of the Physics Department, after a thorough study of the existing electro-mechanical installation of the dome and the necessary modifications needed to be done, in order to operate the telescope remotely. The plan was to build new or modify the existing electro-mechanical setup, which enables the observer to open and close the dome from a distance, control the telescope and CCD camera and eventually perform photometric observations with the above equipment remotely. Since the dome rotates during

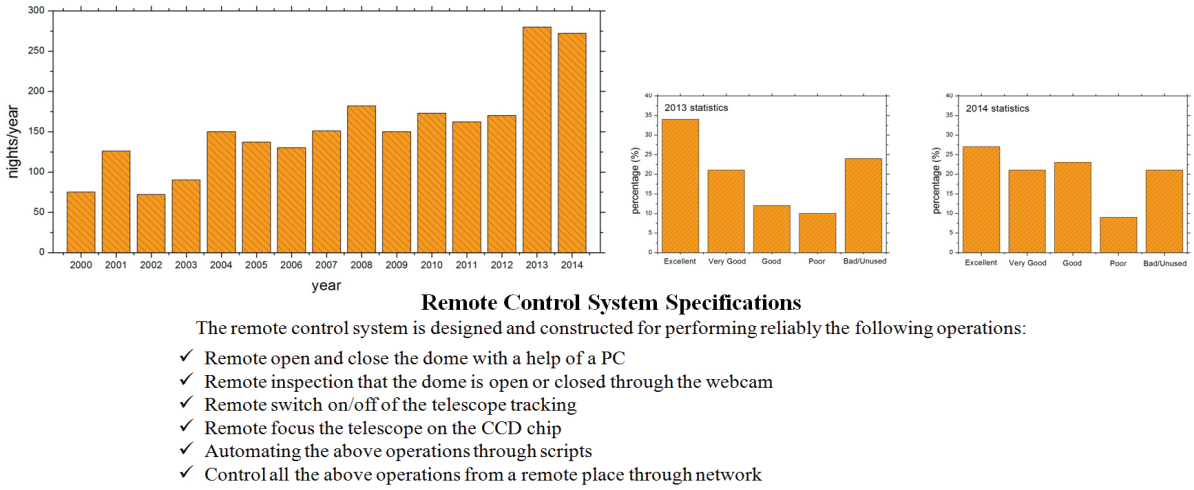

Figure 1: Annual statistics of telescope usage after 15 years of operation. After mid-August 2012 the observatory became remotely controlled, resulting in a rapid increase of observing nights. On average, Excellent and Very Good weather conditions correspond to about 50% of the useful observing nights.

observation, it is not possible to be connected permanently with the electrical installation of the building. We adopted brush connectors which are a simple solution of the issue. In order to ensure a safe operation, the electrical connection is activated only at two dome azimuth positions, acting as open and close switches. When the dome moves in a different position the electrical connection is disabled. For over a decade (2000-2012) almost half a year (140 nights) was used effectively for photometric observations. Automatic scripts and updated software helped significantly in performing photometric and spectroscopic observations over the years. This is reflected in the continuous increase of observing nights through time. After installing the Auto Dome Remote Control System in 2012, the observing nights increased dramatically (almost doubled). The record holder in 2013 reached 280 useful nights (77% of annual usage), out of which 55% were photometric nights of good quality. The histograms in Fig.1 show graphically the statistical results of the first years of remote telescope operation. In an annual basis, Excellent and Very Good weather conditions correspond to about 50% of the useful annual observing nights (photometric nights), while about 25% are characterized as Good/Poor conditions. Bad or unused nights represent only about 25% of the year.

3 Conclusions

The constructed and modified remote control systems proved to be reliable whenever power supply and network connection at the University of Athens facilities was stable. Since 18 August 2012 the Auto Dome Remote Control System operates successfully. With a few indispensable electro-mechanical modifications the full control of the observatory (dome, telescope, CCD camera, focuser or other instruments) can be established through network. A robotic telescope which operates remotely and fully automatically can be used in monitoring celestial targets which vary in a time scale of weeks or months. Fully remote observations, in turn, favour significantly the long-term monitoring projects of blazars and long periodic variables in general. Results and statistics after the first year of successful remote observations as well as real-time instrumental operational performance were presented in a seminar meeting at ESA/ESTEC in Noordwijk, Netherlands in August 2013, where members of the Research & Scientific Support Department (RSSD) used the remote controlled observatory and saw its capabilities in action.

Acknowledgements: The author wishes to thank L. Tzouganatos and Dr. A. Liakos for software support and further modifications at the observatory, establishing a flexible operation since 2007.