Design of a New Telescope Control System for Use in Astronomical Transient Events

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Abstract

Robotic autonomous telescopes provide high level control by selecting astronomical targets for observation, and they usually run under the control of a scheduler. TalonVIEW is a newly designed robotic autonomous telescope control system (TCS) for 16 inches telescope mount for use in astronomic transient events. The telescope control algorithm was implemented in PXI chassis written in GPProgramming (LabVIEW) on real-time operating system (PharLab) from scratch. A new TCP/IP library was also implemented in Talon software to communicate with Pharlab in PXI chassis. Initial setup without any permanent pier and polar alignment showed that the pointing error of the telescope has been obtained as 2.22 arcminutes (132 arc seconds) in RA axis (horizontal axis of the image) and 25 arc seconds in Dec axis (vertical axis of the image), and tracking error has been observed as 4.8 arc seconds per second.

Keywords: Autonomous Robotic Telescopes, Astronomical Transient Events, G-Programming Telescope Control Software.

1. Introduction

Computer-based robotic telescope systems have the advantages of low operating costs with high operating efficiency and high scientific productivity [1, 2]. Some demonstrations of scientific usage of the robotic telescope were given in [1-5]. Generally the term robotic in telescope systems stand for guiding a telescope to a given position and take images or perform more complicated tasks. The term autonomous observatory in astronomy means a robotic telescope and dome are computer controlled in such manner, that all indispensable actions of observation are done automatically, including processing of weather conditions, dome driving, choosing objects to observe, exposing by cameras or other optical sensors, taking calibration images, and so forth. Neither human interaction nor activity is necessary for observation [5]. Removing human control from the observing process allows faster observation response time, so that it makes robotic telescopes respond quickly to alert broadcasts from satellites and begin observing within seconds. This property lets the astronomers to observe transient events (Gamma-Ray Bursts etc.) in the sky.

Telescope control algorithm can be executed on various platforms where LabVIEW runtime is available, among them; Windows and Linux, real-time extension for Windows (RTX), and real-time operating systems (PharLab ETS, VxWorks etc.). Some telescope control software applications on LabVIEW platform have also been given in [6, 12].

Talon, observatory control software (OCS), have already been improved and integrated to new systems at TUBITAK National Observatory (TUG) by using advantages of its open-source software structure [13, 14]. This paper presents a newly designed TCS and adapted to