An Autonomous Telescope Implementation

at the

USQ Mount Kent Observatory

A Dissertation submitted by

Scott Sinclair, BSc

For the award of

Master of Science

University of Southern Queensland

Faculty of Sciences

February, 2010.

Abstract

Over the past decade, the quality and sophistication of optical telescopes commercially available has dramatically increased, with instruments in a class previously only within the reach of professional facilities now commonly possessed by advanced amateurs. A corresponding reduction in cost not only for these optical assemblies, but also for ancillary equipment such as high quality mounts, CCD cameras and computer hardware and software has meant that many areas of research, and in particular those appropriate for high school and university students, are now far more accessible than before, vastly increasing interest in the study of astronomy and astrophysics. At the same time, there has occurred a rapid expansion of the Internet, measurable in terms of its pervasiveness, richness of end-user experience and quality of infrastructure. The combination of these phenomena has meant that most of the issues that have stymied the development of remote and robotic observation have now been largely overcome.

Since early 2004, the author and co-contributors from the University of Southern Queensland's Faculty of Sciences have been developing a system for remote and robotic observation at the Mt Kent Observatory site near Toowoomba in South East Queensland, Australia. Reliable, online access to an observatory is provided, with students being able to conduct scientific-grade photometric and astrometric research using a system built primarily of commercial, off-the-shelf components. Further, fully automated observation is possible, meaning the user is no longer required to interact with the observatory directly, instead being only required to submit imaging requests and wait for their electronic delivery.

The various observatory components are described, example results presented and future directions and possible applications discussed.

Certification of Dissertation

I certify that the ideas, experimental work, results, analyses, software and conclusions reported in this dissertation are entirely my own effort, except where otherwise acknowledged. I also certify that the work is original and has not been previously submitted for any other award, except where otherwise acknowledged.

Signature of Candidate   ...……………………………………………..

                                Dated this …………… day of ………………2010.

ENDORSEMENT

Signature of Supervisor(s)   ...……………………………………………..

                                ...……………………………………………..

                                Dated this …………… day of ………………2010.

Acknowledgements

Firstly, I am grateful to my supervisor Dr. Brad Carter, not only for his professional guidance and candor, but also for his unshakable faith in my ability to successfully complete this project in spite of my own uncertainty.

In addition, without the considerable contributions and dedicated commitment of my peers, the O'Mara Telescope at the USQ Mt Kent Observatory would not be the professional installation that it is today. In particular, I wish to thank Dr. Roy Duncan, Dr. Rhodes Hart and Bender Rodriguez whose combined enthusiasm and application of skills, often in the face of apparently insurmountable challenges, ensured our success.

Finally, to my wife Kirralee and daughters Sophie and Emily, I am eternally indebted for their understanding and on-going support, unselfishly relinquishing precious time that could otherwise have been spent together in order for me to complete this adventure.

Without all of these people, along with those simply too numerous to mention, none of this would have been possible.

Scott Sinclair.

Table of Contents