

THE USE OF A WIRELESS NETWORK TO PROVIDE REAL-TIME AUGMENTED FEEDBACK FOR ON-WATER ROWING

DJ Collins^{1&2}, Dr Ross Anderson¹ & Dr Derek T. O'Keeffe

¹Department of PE and Sport Science, University of Limerick, Limerick, Ireland

²Biomedical Electronics Laboratory, Department of Electronic and Computer Engineering, University of Limerick, Ireland

E-mail: d.j.collins@ul.ie

Web: www.ul.ie/~pess/

INTRODUCTION

All elite athletes today have concentrated training programmes, enabling them to maximise their preparation time for competition. These demanding programmes require next to instant feedback of the performance. Existing techniques to achieve this include data loggers, EMG monitoring and motion analysis systems. However, the majority of these systems are lab based, depend on a physical link between the athlete and the monitoring system and do not provide real-time augmented feedback (rAF). This presents a acute problem when considering on-water rowing where races are held over courses of 2000m.

Commercially available telemetry systems may offer a solution to this problem, however the cost of the majority of these systems (>\$15 000) is outwith the budget of the typical athlete, coach and sport biomechanist. A limited amount of research has been carried out in the area of rAF for rowing (Hawkins 2000; Anderson 2002) and the use of telemetry systems for rowing (McBride & Elliott 1999; Smith & Loschner 2002). These systems illustrate the requirement for a rAF telemetry system, however each of these systems has disadvantages; namely the lab based nature and/or one-way communication.

With recent advancements in wireless technology in the IT sector, new low cost communication technologies suitable for

telemetry have become available; one such technology is the IEEE 802.11b. It is the incorporation of these communication technologies with existing sensors (accelerometers, potentiometers etc.), software and hardware that will lead the way for low-cost two-way wireless communication to be established between the rower and coach.

The aim of this research is to investigate the suitability, from a range and throughput perspective, of 802.11b as a suitable base technology for rAF in rowing.

METHOD

To test the suitability of the 802.11b technology, a test network was constructed. Two Dell Latitude laptops, equipped with LabVIEW 7 and a LinkSYS Wireless 802.11b adapter card, were used to simulate the transmitter (L1) and the receiver (L2). The testing was separated into three separate sections; indoor, outdoor and continuous. Indoor and outdoor testing involved simulating a typical telemetry system by transmitting files of different sizes. The files (2kb to 100kb) were made up of random data. The files were transmitted from L1 to L2 using a LabVIEW coded program. The program recorded the transmission time for each file, to ms accuracy. This procedure was repeated for varying distances, up to 30m for the indoor testing and 150m for the outdoor testing. The final section of the testing simulated the

transmission of a continuous stream of data. An NI-6024E data acquisition card in L1 was connected to a function generator. The function generator produced a continuous data, based on a 200Hz sine wave. A second LabVIEW coded program acquired this data and simultaneously sent this data over the 802.11b network to L2. The latency between acquiring the data at L1 and receiving the data at L2 was calculated.

RESULTS AND DISCUSSION

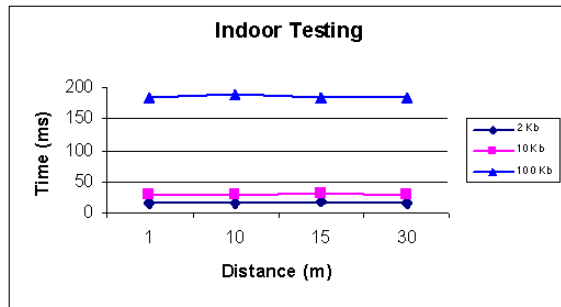


Figure 1: Transmission time Vs Distance for different file sizes; indoor testing.

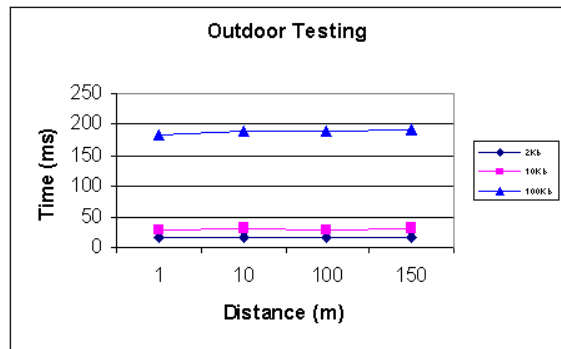


Figure 1: Transmission time Vs Distance for different file sizes; outdoor testing.

As can be seen from Figure 1 and Figure 2 the distance between the transmitter and receiver does not affect the time taken to send data over the 802.11b network. However, it does illustrate that the file size is the determining factor when considering transmission time; the 100Kb file was transmitted in under at just under 200ms. When the continuous data signal was transmitted across the 802.11b network the

time lag was in the region of 200 to 300ms. These transmission times are relatively small, and for rAF in rowing, are inconsequential and may be considered real-time.

SUMMARY

From the results obtained, the possibility of developing a low-cost real-time augmented feedback telemetry communications system for on-water rowing is possible. This would provide a mechanism for rowers, coaches and sport biomechanists to gain valuable biomechanical and kinematical data of a rower's performance as it is occurring. More specifically, as IEEE 802.11 offers a solution regardless of required range or sampling rate. It is on this technology that the developmental drive should be focused as it may offer an all-encompassing solution to both stationary sports (e.g. archery) and ambulatory sports (e.g. rowing). Development of such a real-time augmented feedback system will certainly assist those elite athletes with highly concentrated training programmes.

REFERENCES

- Anderson R, Harrison AJ & Lyons G (2002), In: *The Engineering of Sport 4*, eds S Ujihashi, SJ Haake, Blackwell Science, Oxford, UK, 803 – 809
- Hawkins D (2000). *Journal of Biomechanics* **33**(2): 241-245
- McBrid ME & BC Elliott (1999) ISBS Symposium XV11, Perth, Australia.
- Smith RM & C Loschner (2002) *Journal of Sports Science* **20**(10): 783-791

ACKNOWLEDGEMENTS

This research has been supported, in part, by National Instruments.