CSS Outreach Funding Control School Report

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Introduction
The IEEE CSS Outreach Fund generously funded the Control School outreach program for 2012 and this report outlines the activities undertaken through this program and the outcome of these activities.

Program Mission / Goal
The goal of the Control School program was to deliver a number of one day workshops in East Africa. These workshops were targeted at undergraduate University students in Uganda and Kenya. A detailed overview of the program mission can be found in the initial application which is attached.

Control School Workshops
The one day workshops consisted of a number of sessions (as shown in the table below) with breaks for morning and afternoon tea and lunch. These breaks provided valuable networking opportunities for presenters, staff and students. The content of the workshops can be found at the Control School website, http://controlschool.org.

Time	Events
9.00 – 9.30	Welcome.
9.30 – 10.30	Session 1 - The History of Control.
10.30 – 11.00	Morning Tea
11.00 – 12.00	Session 2 - Control in Industry, Automation and Robotics.
12.00 – 1.00	Lunch
1.00 – 2.00	Session 3 - Control in the Automotive, Aeronautical, and Aerospace Industries.
2.00 – 3.00	Session 4 - Control in Path Planning, Cooperative Control, and Networks.
3.00 – 3.30	Afternoon Tea
3.30 – 4.30	Session 5 - Unsolved Problems in Control.
4.30 – 5.00	Close.

Activities Undertaken in East Africa

Prior to departure we had organised to deliver six workshops (four in Uganda and two in Kenya). We were able to deliver three of these workshops due to a university strike in Uganda and then a country wide university strike in Kenya. The strikes themselves were unfortunate but we did have the opportunity to meet with academics in Kenya even though the workshops themselves could not be run. The activities we did undertake are as follows:

- Delivered workshops at:
  ◦ Uganda Christian University (Uganda)
  ◦ Busitema University (Uganda)
  ◦ Makerere University (Uganda)
- Met with control industry representatives (Uganda and Kenya)
- Met with academics from Moi University and University of Nairobi (Kenya)
- Met with a small startup company using control theory to develop an aquaculture project.

Here is a detailed itinerary:

Date	Activity	Accommodation
Sept. 8	Arrival in Entebbe, transfer to Kampala	Hotel Africana, Kampala
Sept. 9	Transfer to Mbale (near Busitema University)	Maisha Africa Hotel, Mbale
Sept. 10	Workshop at Busitema University, transfer to Sipi Falls,	Sipi River Lodge, Sipi Falls
Sept. 11	Modification and preparation for next workshops	Sipi River Lodge, Sipi Falls
Sept. 12	Modification and preparations for next workshops	Hotel Africana, Kampala
Sept. 13	Workshop at Uganda Christian University, Kampala	Hotel Africana, Kampala
Sept. 14	Workshop at Makerere University, Kampala	Hotel Africana, Kampala
Sept. 15	Visit to secondary school, visit to aquaculture startup, Kampala	J. Residence Hotel, Entebbe
Sept. 16	Flight from Entebbe to Nairobi	Fairview Hotel, Nairobi
Sept. 17	Meeting with Dean of Engineering and professors from University of Nairobi, meeting with control engineering professionals	Fairview Hotel, Nairobi
Sept. 18	Debriefing and report preparation	Private accommodation
Sept. 19	Private travel	Private accommodation
Sept. 20	Private travel	Private accommodation
Sept. 21	Return flights to Zurich, Sydney	

Outcomes

Aside from the activities which were undertaken in Africa we spent considerable time and effort prior to travelling and since returning in ensuring the long term possibilities of this program and we believe that the outcomes that we have achieved in this regards are substantial. The outcomes of this program are as follows

- **Workshop materials** - Production of workshop material, including a number of LEGO

Mindstorms demonstrations. These resources are now available on the Control School website, http://controlschool.org.

- **The Control School website and software infrastructure** – This website is and will remain a repository of information about this program. We have also established software infrastructure and a mailing list to support this endeavour over the coming years.
- **Strong academic connections in East Africa** – All of the institutions in Uganda and Kenya where we delivered workshops (and where we were expecting to deliver workshops) are eager to see us return in future years to provide additional control theory workshops. Beyond the workshops themselves the institutions are eager to explore partnership opportunities and to identify how it might be possible to encourage staff and students from established institutions to visit East Africa and work with the staff and students there. There are a great many opportunities to explore here and we outline them briefly in the sections that follow.
- **Emerging relationships in Tanzania, Malawi, and Rwanda** – From our planning for this trip and activities on the trip we were able to identify academic institutions in Tanzania, Malawi and Rwanda that would be interested in hosting Control School workshops in coming years.
- **Interaction with industry** – We were fortunate to be able to meet with a number of industry representatives and they have expressed interest in supporting our activities and providing staff for future outreach activities. There is an emerging control industry in Uganda and Kenya and companies are keen to support local engineers moving into this field.
- **Volunteers** – Through the planning and delivery of these workshops we have identified and engaged a number of volunteers both in East Africa and further afield. These volunteers are passionate about developing further workshops and in delivering them in Africa and in other developing regions of the world. We believe that these volunteers (including support from a number of universities in Australia) will allow us to grow the program in the coming years. We have currently identified volunteers in Australia, USA, Zurich, Uganda, Kenya,

Follow On Activities

Based on the success of these workshops and of the program more generally we are eager to conduct follow on activities that support the growth of the Control School Outreach program. The follow on activities that we are hoping to run include:

- **Annual / bi-annual Control School workshops** - We are aiming to secure funding to allow us to return to Africa (and other regions) to continue to deliver the workshops we have developed. All of the feedback we received for these workshops was very encouraging and as mentioned previously all institutions are eager to see us return. This, coupled with other institutions who have expressed a desire to host workshops encourages us to believe that the long term impact of these workshops and their associated activities could be substantial. We are currently looking for sponsorship (both ongoing support from IEEE CSS) and from a number of other organisations, institutions and individuals to support these activities going forward.
- **Increase online repository of demonstrations and learning materials** – We are eager to create a valuable online repository of control and systems theory content on the Control School website. This will not only aid students of the workshops but will be a valuable resource for anyone interested in the control discipline.
- **Funding for controls projects in developing countries** – On our visit we identified a number of promising projects that are based around the clever application of control and that would be worthy recipients of small amounts of funding and support from the controls

community. These projects are being undertaken to solve significant problems and require very limited resources. We believe that the relationships we have established would leave us well placed to provide small grants to support these projects.

- **Expand to more countries and levels of education** – The success of these workshops has encouraged us to believe that the structure and resources we have developed could be equally well applied in other regions / countries and could be used to underpin outreach programs for primary and secondary school students in both developed and developing countries. We are eager to explore the opportunities here.

Funds Disbursed

Please find attached an expense report detailing the disbursements made.

Conclusion

The Control School Outreach program was a great success primarily due to the funding provided by the IEEE CSS Outreach Fund. We are greatly appreciative of the funding and are eager to ensure that the program we have developed grows beyond this initial program. We have outlined the activities and outcomes from the first year of operation that we have received funding for but are eager to engage further with IEEE CSS to understand how we can expand this program in years to come. We look forward to hearing your thoughts on our achievements to date and the future partnership opportunities that exist.

Kindest regards,

Lachlan Blackhall and Tyler Summers

Appendix - University Expectations

During each workshop we asked staff and students for their expectations of the workshops and what they would like to gain from these workshops. The following is a list of the responses we obtained.

Student Expectations
- Control theory project ideas for undergraduate students
- Information about sensors (how they work, when to use them, etc...)
- How to design control systems (i.e. the hardware and software used and how to implement control systems.)
- Uses of control theory in the local community
- A list and explanation of all the components of a control system
- A understanding of how different control systems work together
- Opportunities for IT students in control
- Scholarships and funding for African students
- Future opportunities / career prospects for control theorists in Africa and the value of further control theory study (particularly PhD studies)
- Opportunities for field trips
- Opportunities for hands on control theory workshops, particularly with the Lego Mindstorms Kits
- Notes, resources, educational content, courses in control, projects in control

University Expectations
- Partnerships with other universities.
- Project collaborations and sponsorships.
- Allow staff and students to travel to and spend time at the universities in Africa.
- Old equipment donated to African universities.