

SMBE SA/NT

April, 2019

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Is this the key to the future of BME?



EDITORIAL

It's changing...

Michael Smith, Editor

As we have come to the end of the first quarter of the calendar, your various healthcare institutions will be thinking about budgets for the next financial year. Which devices will be obsolete? Which will need replacing in the next year or three? It used to be that medical devices had a moderately predictable end-of-useful-life. Perhaps you use a 7-10 year lifespan as a rule, or perhaps you wait until clinical users change their needs and demand updated equipment. Now there is a third pressure on equipment replacement: *networkability*.

With most Australian states working on implementing various electronic medical record systems, there is a relatively sudden need for medical devices to be connected to data networks so that patient data can be captured for later review. This need could easily render a thousand bedside vital-signs monitors obsolete overnight, not to mention any number of high-end ventilators and fleets of infusion pumps. While accountants will find challenges funding replacements for equipment fleets, technicians must upskill themselves to deal with networking and data-related device failures. Furthermore, biomedical engineering is no longer benchwork; its effectiveness is becoming dependent on successful collaborations with ICT professionals. Looking backwards, biomed looks like a specialization of maintenance; looking forward, we are becoming network managers for medical systems.

In the Northern territory, various departments are looking at upskilling their technicians to become more ICT-literate, while trying to adapt state-of-the-art medical systems for remote desert conditions. Meanwhile, Flinders University continues to produce talented students with outstanding projects. A postal vote is being organized to formally add the N.T. to the name of the legal entity of the SMBE SA, and to allow on-line voting as well as postal voting, so that we can use the internet to vote in the future.

NT REPORT

Remote biomed placement

Lloyd Oehme spent 20 weeks with Medical Equipment Management in Central Australia as part of Flinders University's Work Integrated Learning program.

I came to Alice Springs to complete a Work Integrated Learning placement with Medical Equipment Management. I had only a limited understanding of not only the field of the project work I was about to undertake, but also clinical engineering itself.



*Mannikin trouble with Lloyd...
Image: Lloyd Oehme*

During my placement, I had the opportunity to visit various communities surrounding Alice Springs, experiencing the remoteness of some of these places for myself. I saw firsthand the difficulties in simple logistical operations created by vast distances from service suppliers and the remote users. The research project I was working towards, focussed so much on the challenges posed by attempting to provide high quality health care in desert environments, was suitably affected by similar challenges faced by remote area clinics, even from the relative comfort of the biomedical technicians workshop.

Following my five-month placement, I departed Alice Springs with an incredibly valuable appreciation for the unique challenges associated with remote healthcare, dramatically increased technical capabilities and understanding, strengthened work ethic, and immense respect for remote health care providers of all types. Most importantly, I have validation that biomedical engineering is the field I want to work in, remote or not.

POSTAL VOTES

SMBE to go to the POLLS in May.

Ferah Kalkan is the SMBE SA/NT President.

As you may have heard on the local 'SMBE SA Inc.' Grapevine news, the Society would like to put forward an official change in name to 'SMBE SA and NT Inc.'. This is to officially include our large number of respected members from NT.

We need your vote to decide.



Image: Unknown. Licensed under [CC BY-NC-ND](#)

The SMBE Inc. Constitution has been reviewed and there are requirements around voting being postal and the minimum days of notification prior to a meeting via an agenda.

You will have 30 days to post your votes to be included.

SMBE would like to change the constitution to not only allow for the name change but also to allow electronic voting methods.

**** Please make sure your postal address is up to date. Membership Renewal form attached. Send information to secretary@smbe.asn.au**

PRIZE WINNERS

SMBE SA/NT Flinders University Biomedical Engineering Outstanding Project Award 2018

Reuben Smith was the winner of the prize for Flinders University's most outstanding Biomedical Engineering Project for 2018.



*L to R: Ferah Kalkan, Reuben Smith, Laura Newton
Image: Supplied.*

The Design and Development of a Novel Sports Agility Tester

Introduction: Performance testing protocols are a widely accepted way of evaluating the ability and skills athletes possess in sports clubs, sports science and physiology. Performance testing allows monitoring of progressive improvement, assistance in talent identification processes, and determination of positional roles and responsibilities. Agility has become an increasingly important attribute within performance

testing regimes. Currently implemented agility tests such as the Illinois agility, AFL agility, 5-0-5, T-test, Pro-agility and 3-cone drill, often involve an athlete running around a series of objects in a similar manner for each effort, demonstrating pre-planned and repetitive behaviour with no real thought when undertaking the test.

The design and development of a novel system capable of testing all components of athlete agility was proposed.

Therefore, a major problem with these currently implemented “agility tests” is that they lack any perceptual and decision-making attributes, which would be required during in-game performance. They do not truly represent all components of agility; testing only the physical attributes. Thus, the design and development of a novel system capable of testing all components of athlete agility was proposed.

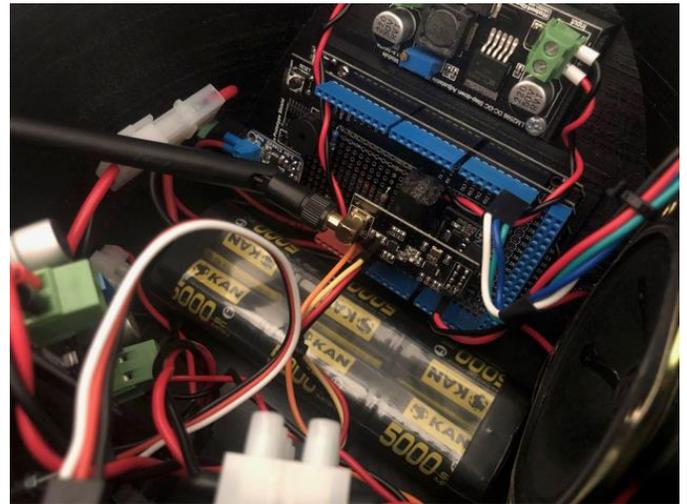
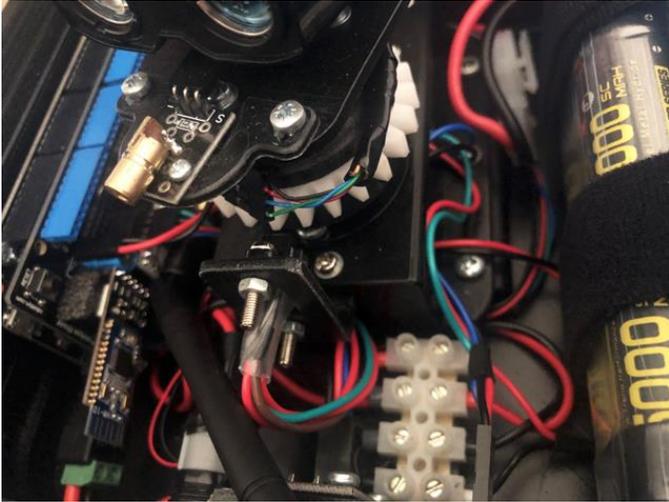


Image: Reuben Smith

Methods: An engineering design process consisting of problem definition, conceptual design, solution concept, design embodiment and detail design was undertaken. In addition to significant research and development, the iterative process involved integrating mechanical, electrical and software engineering with rapid prototyping technologies to construct a proof-of-concept

prototype which was built from the ground up. The system was developed to contain several devices, including one master component capable of controlling multiple slave devices through wireless communication.

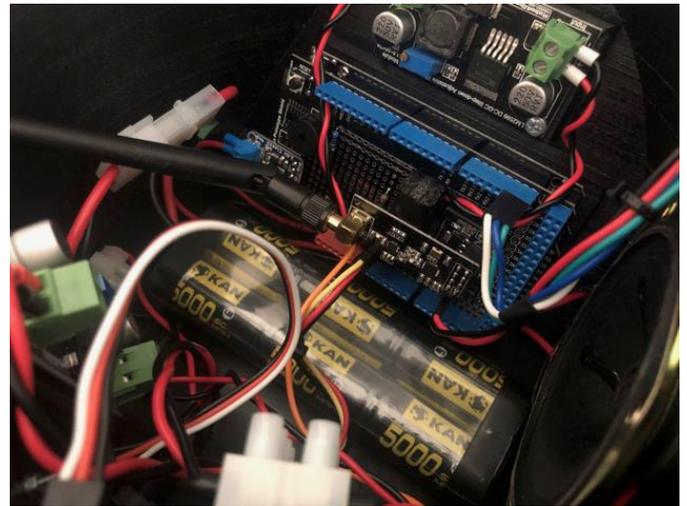


Microcontrollers were used to process various computations and to control a variety of peripheral hardware that made up the core of the electronics. Custom 3D printed enclosures were designed and developed, which encompassed the electronic components. Software and hardware tests ensured successful integration of all parts to maintain the primary function of testing athlete agility.

It is anticipated that this prototype will pave the way for the advancement of athlete performance testing

Results & Discussion: A fully functional prototype system was successfully developed, which had the capacity to test an athlete's agility, incorporating both perceptual and decision-making factors as well as the physical attributes of the construct. The prototype met 92.3% of first order engineering specifications established to satisfy the functional requirements. The system, for the first time, boasts the capability of self-measuring the components geometric layout for test replication and standardisation. The system presents a series of random stimuli (acting as a reactive component) dispersed across

a testing zone that the athlete must deactivate, thereby activating another component successively. Additionally, sport specific apparatus (such as an AFL football, netball or basketball) can be incorporated to add a sport specific ball-handling element to the test. The time taken to remove all sport specific apparatus from the test is recorded by the system and the results are sent directly to a laptop or smartphone. The test was developed so that an athlete is unable to anticipate the marker activation sequence using carefully coded algorithms, maintaining the perceptual and decision-making factors associated with agility.



Conclusions: By employing a logical and systematic engineering design process, disciplines of mechanical, electrical and software engineering were fused to design and develop an innovative, tangible and fully-functional prototype. This novel system is predicted to assist coaches in talent identification processes, monitoring progressive improvement, and determining positional roles and responsibilities of athletes. It is anticipated that this prototype will pave the way for the advancement of athlete performance testing to more closely represent athletic and game demands within performance testing batteries.

What is happening in your region? Send stories and articles to: Secretary@smbe.asn.au

SMBE Outstanding Biomedical Engineering Project 2018 – Runner up

Emilia Corbo was the runner-up for Flinders University's most outstanding Biomedical Engineering Project for 2018.



*L to R: Ferah Kalkan, Emilia Corbo, Laura Newton
Image: Supplied.*

Design and Development of a Wearable Device to Measure Lower-Limb Impact Dose during Competitive Netball Play

Emilia Corbo, supervised by Dr Kym Williams, Professor Mark Taylor and Mr David Hobbs, with acknowledgements to the Contax Netball Club

Background

Netball is the most popular team sport for girls in Australia outside of school hours (Australian Sports Commission, 2018). Incidence of injury in netball has been reported to be as high as 30.1% during a 6-day competition, with lower-limbs most

prone (Cunningham & Cunningham, 1996). However, athlete monitoring technology is currently limited by its expense and inability to assess impact dose through the lower-limbs.

Objectives

Project objectives surrounded contribution to the design of an inexpensive device to measure lower-limb impact dose for active injury prevention in netball by:

- Identifying an accelerometer-based variable to infer impact dose, and technical device specifications
- Assessing in-situ effectiveness and viability
- Developing a feasible implementation plan

Methodology

In the initial 'Correlation and Feasibility Study', four participants were recruited to undergo a sequence of 10 game-based movements with Delsys Trigno sensors (150Hz) attached at the thigh, shank and lateral malleolus, with capture from ATMI OR6-7 Force Plates (2000Hz) and Vicon 3D Motion Capture (250Hz) for force and acceleration correlation within a motion analysis laboratory.

Six SA Premier League players then participated in 'In-Situ Testing' with Delsys Trigno sensors fixed at the lateral malleolus (Fig.1), which collected data during repeated movement sequences on bitumen and sprung-timber netball courts, as well as competitive game-play.



Figure 1: Delsys Trigno fixed at lateral malleolus with medical foam wrap

Application of the subsequently developed impact dose algorithm then allowed a device implementation plan to be formed.

Results

In the 'Correlation and Feasibility Study', the amplitude of the acceleration signal in the inferior/superior axis (A_{IS}) at the shank was shown to differentiate low, moderate and high impact movements at various limits (Fig.2).

A Wilcox Signed Rank test showed greater A_{IS} amplitude on the bitumen compared to sprung timber court ($p < 0.05$) from 'In-Situ Testing'.

A_{IS} amplitude (Fig.4) and impact dose (Fig.5) similarly reflected 'light-footed' and 'heavy-footed' players, independent of weight or surface.

Players reported no interruption to play and promising competitive game feasibility for the device (Fig.3).

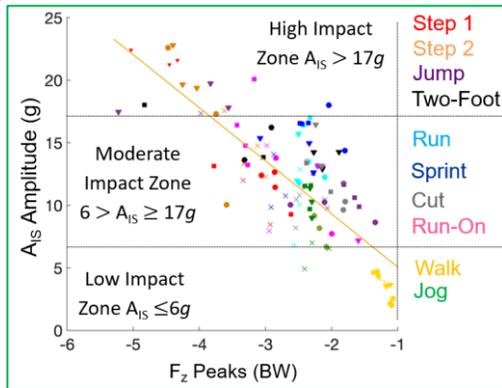


Figure 2: Correlation between AIS amplitude from an accelerometer at the shank and FZ peaks (analogous to vertical ground reaction force), with resulting impact zones

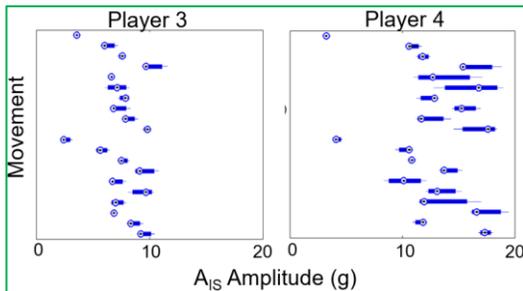


Figure 4: Ranges of AIS amplitude obtained by player 3 and 4 during 'In-Situ Testing' for various movements

Conclusions

An impact dose model was developed based on count of impact zone incidence per unit time, where low impact was indicated by $A_{IS} \leq 6g$, moderate impact between $6 > A_{IS} \geq 17g$ and high impact where $A_{IS} > 17g$.

An increase in surface stiffness, between the bitumen and sprung timber courts, resulted in an increased lower-limb impact dose. However,

individual player monitoring revealed significant variation in impact dose among players for similar movements, which was independent of weight and surface, and likely a consequence of technique.

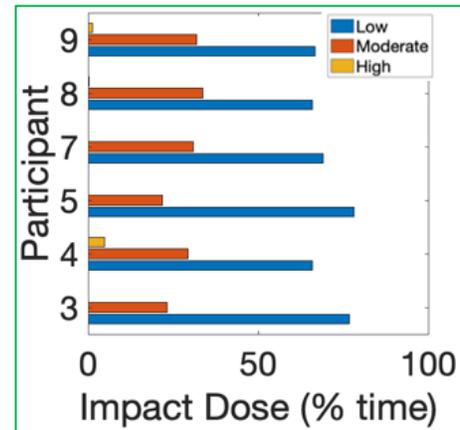


Figure 5: Impact dose obtained during a quarter of game play during 'In-Situ Testing'

The developed protocol could be used for both player impact dose monitoring and assessment of individual landing kinematics.

Specification	Requirement
Accelerometer	3-axis
Accelerometer Sensitivity	$\geq \pm 13g$
Accelerometer Sampling	≥ 150 Hz
Transmission Range	$\geq 35m$
Epoch Window	~ 1 second
Battery Life	≥ 2 hours
Size	$\sim 27 \times 24 \times 13$ mm

Table 1: Device Requirements

Recommendations

In order to pursue active injury prevention in netball and protect players at all competition levels, the impact dose model should be implemented through hardware and software development to meet developed specifications (**Table 1**) for an initial prototype. Additionally, kinematic adjustments which resulted in the vast difference in observed individual impact dose should be further explored.

As arising from impact dose assessment on both sprung-timber and bitumen courts, Netball Australia must develop regulations and test methods for mechanical properties of netball courts, similarly to England Netball.

AWARDS AND PRIZES

SMBE SA/NT Encouragement Award

Congratulations to James McClay on receiving the 2019 SMBE SA/NT Encouragement Award.

This is an award that considers nominations by peers of those they see deserving of recognition for their abilities, skills, motivation or commitment that, in their mind, sets them apart.

Various nominations said that James went out of his way to help others:

“James has shown initiative on several occasions such as being the lead biomed for the recent \$14M neonatal redevelopment project. James is continuously keen to learn.”

“My dealings with James have led to very positive experiences. A person who would go the extra mile.”

“In my interactions with James, he has taken on his responsibilities and ownership for equipment handling within the hospital. He has been effective in organising equipment and returning equipment proactively. I can vouch for his great communication and hard work.”

So, it gives me great pleasure to announce James as selected for this year’s Encouragement Award by the SMBE SA/NT committee.

Prize for this award is for full registration at the Annual Country Biomedical Engineering Training Seminar. The SMBE NSW Annual Biomedical Engineering Conference was held at the Orange Ex-Services Club, NSW. 24th - 27th March 2019.

Prize for this award is for full registration at the 2019 SMBE (NSW) Country Technicians' Training Seminar at the Orange Ex-Services Club, NSW, March 24th to March 27th. More information can be found at: <http://www.smbensw.org.au/>

About the SMBE SA/NT Encouragement Award

Nominations are sought for this award at the end of each year.

Philosophy

This annual award is to be made as a means of acknowledging and encouraging excellence amongst Biomedical Engineering practitioners.

Process

The recipient shall be selected by the council of the SMBE SA/NT from amongst candidates who shall be nominated by a peer who deems them worthy of such recognition

The nomination must give a clear indication or evidence of the nominee's abilities, skills, motivation or commitment that, in their mind, sets them apart and makes them deserving of particular recognition.

The Award

The award shall comprise a funded visit to a biomedical engineering conference or seminar as selected by the committee. The award is open to all BME practitioners, from within SA and the NT, be they SMBE members or not.

Conditions

- The recipient must be able to attend the conference, in either their own or their employer's time.
- The recipient must provide an article for the newsletter, either reporting on the conference or seminar, or on another item of interest to the society. The award may be forfeited if this requirement cannot be fulfilled.
- Individuals holding position on the council of the SMBE (SA) at the time of judging are ineligible for consideration.
- All entrants are eligible for minor awards of complementary SMBE (SA) membership for a one-year period.
- The SMBE (SA) council reserves the right to not make the award.

Nominations

The Nomination Form should be printed out, signed by the proposer and the nominee, and should be forwarded to the address indicated. Please contact Honorary Secretary for further information.

SMBE SA/NT Scholarship Award \$1000

Applications are continuously sought for this worthwhile award.

Philosophy

The SMBE SA/NT Biomedical Engineering Scholarship is provided to advance knowledge amongst Biomedical Engineering practitioners in South Australia and Northern Territory.

Process

Upon receipt of an application, the application shall be assessed by the council of the SMBE SA/NT

The Conference/institution be a worthy event/place for a BME practitioner to attend or present at. Attendance by the practitioner contributes to BME knowledge in the state/territory

The Award

The scholarship is financial support (up to \$1000) to attend or present at a biomedical engineering conference or institution.

Conditions

Open to all who have been members of the SMBE SA/NT for at least three years (except council members)

Australian Biomedical Engineering Conference (ABEC) Medtronic Travel Grant

The \$1,500 grant was funded this year by *Medtronic* for a student or postgraduate in SA or the NT to present either an oral paper (preferred) or poster at the upcoming ABEC. Unfortunately, the 2018 prize was not awarded.

To be eligible for the 2019 scholarship, the applicant must:

1. Be a member of SMBE (SA/NT) – can join immediately to be eligible. Refer to SMBE (SA/NT) website for application.
2. Accepted to present at the conference (preference given to students accepted for oral presentations).
3. Agree to write a report on the event and submit it for publication in the SMBE (SA/NT) newsletter (no more than two A4 pages).
4. Submit relevant receipts for reimbursement up to the value of \$1500

Please attach any documentation that will support your application including an abstract acceptance. Preference will be given to non-committee members. Learn more at Medtronic.com.au.

SMBE SA/NT Flinders University Biomedical Engineering Outstanding Project Award

The SMBE SA/NT Outstanding Honours or Masters Project Award was created in 2003 and is awarded to a Biomedical Engineering student for their superior work towards their Honours or Masters project.

The award is based on practicality of the design, project development and outcomes and explanation of work at the exposition day.

- 1st prize Award: \$500 cash prize, a Certificate & 1-year free membership to SMBE SA/NT.
- 2nd prize Award: Certificate & 1-year free membership SMBE SA/NT.

The award is judged on Expo Day at Flinders University by members of the Council. For info, please contact secretary@smbe.asn.au

This award has 2 conditions:

1. The winning student and runners up are expected to write a short article for the SMBE (SA/NT) newsletter summarising their project.
2. A photo should be taken of the project and the presentation of the award for inclusion in the next SMBE (SA/NT) newsletter.

For info, please contact secretary@smbe.asn.au

2019 CONFERENCES

SMBE-NSW 2019 is heading out West...

The 2019 conference was held in Orange at the Orange Ex-Services Club from 24 to 27 March 2019 From <http://www.smbensw.org.au/>. Did you attend? Please send the best story of the conference to Secretary@smbe.asn.au

ABEC 2019

The 2019 conference will be held at the University of Melbourne on the 17th to the 20th of November. More information here:

<http://abec2019.org.au/>

SMBE SA/NT MEMBERSHIP

New SMBE SA/NT members

Please welcome new members to the SMBE SA/NT:

Benjamin McCarl

Trish Williams

Rajeev Nallamothu

Jaime Espinosa

Renewal

Do you know if your SMBE SA/NT membership is current? Would you like to confirm your membership? For a membership application and related questions, please contact treasurer@smbe.asn.au.

Certificates

Are you a SMBE SA/NT member without a Membership certificate? Would you like to update your email or contact details? If so, please contact the SMBE SA/NT secretary: secretary@smbe.asn.au. If you require a copy of your membership certificate, please advise by email and we can provide you with one.

EVENTS IN PLANNING

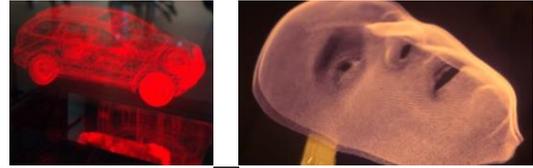
May 29th: AustoFix

Handling the entire process from materials selection through to packaging of Orthopaedic medical devices at the purpose-built manufacturing facility in Adelaide.



May: VOXON PHOTONICS

Creators of the world's most advanced 3D volumetric display. 3D volumetric technology that brings digital content to life.



Watch out for the following event announcements in the new year. Check Facebook and your inbox for invitations...

Coming soon: Workshop on newly released AS3003:2018

Presentation on the latest version of AS3003. Look out for details on webinar enabling remote access including members in NT.



Coming soon: SAGE Automation

Automation & Control solutions from Defence, to Smart Transport, Explosives Control, to Manufacturing.



SMBE SA/NT IS ON FACEBOOK!

Now is the time to start following the SMBE SA/NT Facebook page. Get on-board so that you do not miss out. Simply search within Facebook for SMBE SA/NT:



<https://www.facebook.com/SMBESANT>