Research & Innovation Newsletter

Publication of the Graduate Studies and Research Office

Issue 3

October 2010

His Majesty presenting graduation degree to HRH Paduka Seri Pengiran Anak Isteri Pg Anak Sarah at the 22nd convocation on 30 September 2010. (Photo by Azrol Azmi, Borneo Bulletin 1 October 2010).

UBD celebrated her 22nd convocation on 30th September 2010 with 2 PhD Graduates, 67 Master's Graduates, 720 Degree Graduates and 325 Post Graduate diplomas. Among His Majesty titah on this occasion was that if UBD aspires to achieve global status, quality research, publication, education and teaching should be on par with world's leading universities.

Towards this aspiration, the Graduate Research Scholarship scheme is introduced by His Majesty Government with the aim that this scholarship will enable UBD to attract talented local and foreign graduates to do their post graduate programmes at UBD.

His Majesty also highlighted UBD's successful collaboration with IBM in establishing the UBD-IBM Centre that aims to improve research quality in UBD. However, he noted that diversity in research and improvements are still needed and expressed his hope that efforts taken thus far could generate interest among government and private bodies to "collaborate in producing excellent research".

His Majesty also noted that apart from excelling academically, UBD graduates have also done well in co-curriculum activities as proven by their involvement in representing the nation in various national and international competitions including sports, public speaking, robotics and al-Quran recitals. "These involvements are important in developing holistic individuals", His Majesty stated. He also called for graduates' contribution to the country's growth and encouraged them to face any challenges, be it on a national or a global scale.

The establishment of Sultan Omar 'Ali Saifuddien Centre for Islamic Studies was also announced by His Majesty. The Centre will offer postgraduate and research programmes in Islamic studies which hopefully, will produce Islamic experts who can analyse current issues

based on an Islamic perspective. Since UBD's establishment, Islamic studies have become the core of the organisation's structure and its programmes.

Five postgraduate programmes will be introduced in UBD, viz.; Masters in Energy Studies, Masters in Crop Technology, Masters in Computing and New Media, Masters in Logistics and Masters in Asian Studies. This was announced by Dr Hj Zulkarnain Hj Hanafi during the university's 22nd convocation ceremony.

The Vice-Chancellor also added that with His Majesty's wisdom and leadership, the university will also launch a new initiative called "The International Consortium of Universities for the Study of Biodiversity and the Environment" (**iCUBE**). Membership in this consortium is made up of world class universities from the region, East Asia, Europe and the United States. The consortium will provide the framework for cooperation in research, teaching and learning on issues related to biodiversity, climate change and the environment.

UBD-IBM Collaboration

An IBM Blue Gene supercomputer is coming to Brunei. This will be the first of its kind in the ASEAN region.
IBM and Universiti Brunei Darussalam have just signed an agreement to collaborate on climate modeling research. This will investigate the impact of climate change on flood forecasting, crop yields, renewable energy and the health of rainforests in the region.
The collaboration will help Universiti Brunei Darussalam accelerate its research capabilities in biodiversity, energy and agrotechnology.

New Name "Graduate Studies and Research Office"

On another matter, the name of Postgraduate Studies and Research (PSR) has now been renamed to Graduate Studies and Research (GSR) as approved at Senate meeting on 21st August 2010. Of course changes will take sometimes to complete, so for the time being PSR and GSR are synonymous.

Graduate Studies Matters

New Graduate Programmes

The University is starting new graduate programmes in January 2011. These are Master of Energy Studies from Faculty of Science, Master of South-East Asian Studies and Master of Arts in New Media from Faculty of Arts and Social Sciences. There are more new programmes planned to start in August 2011.

Graduate Research Scholarship Scheme

His Majesty, the Sultan has announced the introduction of Graduate Research Scholarship Scheme in the 22nd Convocation of the Universiti Brunei Darussalam.

The Scholarship is introduced to facilitate and promote research degrees in order to develop the University into a research-intensive university, and also to expand and enhance the quality of graduate programmes and graduates.

It is open to ALL candidates on competitive basis. To be eligible a candidate must be:

- Below 40 years old;
- Enroll full-time in a *graduate degree by research* (*PhD and Master by Research degrees*) (outstanding students applying for Master by Coursework may be considered); and
- Demonstrate a good academic track record.

The Graduate Research Scholarship includes:

- Monthly allowance Brunei Dollar 1,500 (Maximum period of 2 years for Master by research and 3 years for PhD programme) with tuition fees waiver.
- Passage to Brunei Darussalam, from and back to home country for overseas candidates.
- Allowances for field research:
  - Brunei Dollar 2,000.00 for Master by Research candidate.
  - Brunei Dollar 3,000.00 for PhD candidate.

Candidates applying to enter Graduate Programmes by Research are encouraged to apply.

E-mail enquiries can be sent to: **office.psr@ubd.edu.bn**

Innovation and Enterprise Office (IEO)

The IEO is now set-up to assist researchers wishing to apply for a possible patent and other related IP matters. Researchers can write for the time being either to the Dean of GRC or AVC (**New Initiatives and Innovation**) stating what is novel, utility (usefulness) and non-obvious (inventive step) in their claim(s). The University have fund to file for patent overseas.

Researchers are remained not to disclose their invention or research in whatever form before they have taken the necessary action to protect their invention or research.

Further information about IEO and their functions can be found in UBD website.

The IEO will have 4 sections when it is fully functional, viz.; IP information and advising unit, IP education and entrepreneurship unit, Commercial affair unit and Patent documentation and information unit.

The IEO will be under the charge of a Director who will report directly to the AVC (**New Initiatives and Innovation**).

New courses and activities related to IPR will be offered soon to staff and students.

Research Projects Approval

At the last meeting of URC (Business) on 21st July 2010, the following research project was approved subject to amendments and/or clarifications:

Dr Linda Lim Biaw Leng, "Investigation of biosorption (bioremediation) ability of Artocarpus waste toward heavy metal ions"

The next meeting to consider research proposals by URC (Business) is tentatively scheduled for mid October 2010. Staff can

submit their research proposals to the Office of Dean of GSR through their respective Dean.

Science and Technology Research Fund Matters

Dk Hjh Noryoul Elia Fatimah bte Pg Hj Ibnu Basit, one of the S&T project officer has left to pursue her Master in Public Policy in UBD. We wish her all the best in her study. GSR would like to welcome Andrea Tay, Mr Ahmad Raimie bin Hj Mohammad and Mr Lim Sei Heng as S&T project officers. They and Dyg Rena bte Hj Aliuddin will continue to assist researchers in procurement and administrative matters related to their research funding.

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Research Activities

Multi-Agent Autonomous Mobile Robots.
Researcher AP Dr. Frank Nickols

Introduction

The deliverables for this research are five walking six-legged robots or "hexapods". The five robots have been assembled and one is shown in figure 1.

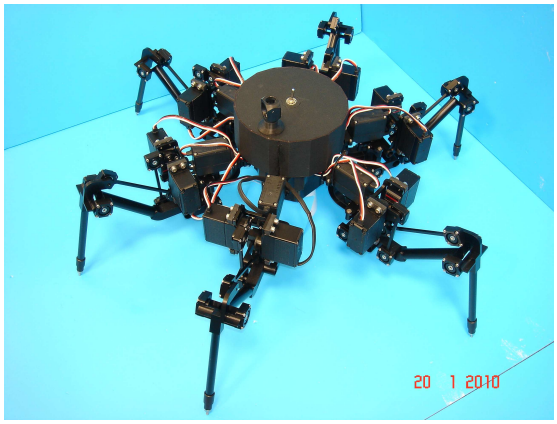


Fig. 1. A six-legged robots or "hexapods" built by the researcher.

A great deal of effort has gone into the mechanical design of these robots to produce a reliable and robust robot that is lightweight, stiff and strong. This has been largely achieved by using 60 very low friction ball race bearings for the many rotating joints in each robot together with computer controlled precision (CNC) machined aluminium alloy and plastic structural components. Each robot is articulated by 18 high quality servomechanisms that give precise leg motion at a rapid rate if desired. The mechanical kinematic design has been carefully designed to enable the robot to walk near to kinematic singularities that is a similar action to human beings walking in a standing up position; just imagine how tiring it would be to stand and walk in a squatting or crouched position. This means that the battery life between recharge is significantly enhanced.

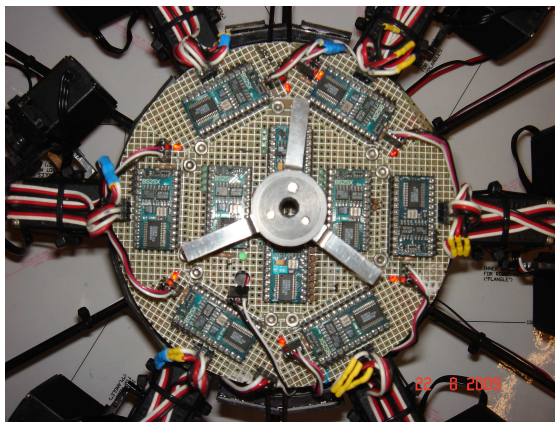


Fig. 2. Parallel processing microcomputer system.

The electronic and computing side has also received a great deal of design attention resulting in a computationally efficient parallel processing microcomputer system, shown inset in figure 2. The microcomputer system is responsible for (i) the legged motion and behaviour patterns together with (ii) the processing and computationally intelligent interpretation of sensor information. Novel algorithms have been developed to solve complex inverse kinematics equations at a rate of 900 equations solved every second. A battery pack is centrally mounted beneath the microcomputer system.

The next stage would be to develop the robots in the area of "swarm behaviour" robotics. This area is receiving a great deal

of attention in robot labs throughout the world. The idea is to program the robots to collaborate and sometimes to compete with each other to achieve tasks and goals that would not be possible by just one robot alone. The Jet Propulsion Laboratory is doing a lot of research in this area in developing such robots to carry out tasks on the Moon and Mars which are the focus of current space exploration.

Application ideas of the research

Some of these ideas can be applied soon but others are very challenging are in the area of:

1. Biodiversity and Biomimetics (the science of mimicking biological systems)

The details of the diverse range of biological systems around us represent an inspirational natural creativity that we seek to understand and then mimick with devices that can aid our further understanding of the natural world around us or can synergistically improve or lives.

The hexapod robot represents such a biomimetic device. The robots, fitted with GPS, pitch, roll, yaw attitude and compass sensors, and acting as legged autonomous roving agents in the rain forest would be capable of data logging quantities such as temperature, rainfall, sunlight and position. They could also be fitted with cameras to recognize and data log certain images or to record images at predetermined time elapses. The robots can maintain communication between each other and each robot can act as a repeater station to share information or to send data back to a manned home station. The batteries can be charged by photovoltaic cells. The robots could also be equipped with microphones with sensitivity at audible and ultrasonic frequencies. Rather than record information, the robots could also be programmed to respond to certain sounds by emitting a sound pattern with a sound transducer or carry out a robotic leg gesture that has particular meaning to a forest animal such as a frog.

2. Medical Physics

Each leg of the six legs of the robot is an independent precision 3 degree-of-freedom positioning device. The robot body is made mobile by the six legs and the dexterity of each leg means that the robot body has 6 degrees-of-freedom both whilst moving and whilst at standstill. The robot can thus be thought of as a mobile Stewart platform or as a mobile CNC machine. The robot body can be equipped with medical tools such as a camera, ultrasonic transducer or marker pen and the robot used to carry out medical tests and procedures. The leg tips or feet of the robot can be fitted with tools or manipulators that are used for non life threatening procedures.

3. Energy

The robot has a general use as a Mobile Inspection, Maintenance, Data logging Autonomous Communication Robot; a “MIMDAC” robot. As such the robot could be equipped with special feet to enable it to perambulate over photovoltaic cells and assess their condition and report any necessary situation. If necessary the robot can carry out on-the-spot repairs.

4. Education

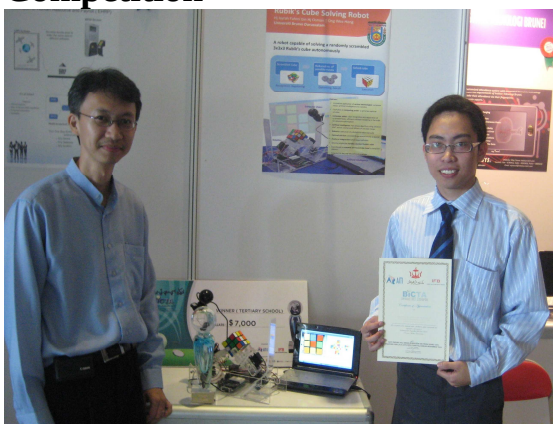
The science associated with the robots has general application in education for such intellectual topics as computational intelligence, mathematics of inverse kinematics, behaviour pattern analysis and real time computer programming. The individual robot leg and the complete robot are very suitable for the teaching of short courses concerned with robotics and computational intelligence. It would be an interesting project to get students interested in a hexapod challenge for the RoboTech competition held annually here in Brunei. Later this year some of these robots will be used in an interactive learning platform for science students in a pilot study (I am co-researcher in a parallel UBD research project) on innovative

pedagogies. The PI for that project is Assoc. Prof. Mani Le Vasan.

UBD Talk Time

If you would like to give a talk in Talk Time, you are most welcome. Please contact the Dean, GSR or email: office.psr@ubd.edu.bn

Robotic project won first place in Tertiary Category in BICTA Competition



A second year Computer Science programming project, Rubik's Cube Solving Robot, won the first place in the Tetiary Category in Brunei Info-Communication Technology Award (BICTA) 2010 competition. This is the second time Hj Isyrah Fahmi bin Hj Osman won prestigous award with his Rubik's Cube Solving Robot. Hj Isyrah Fahmi developed the robot in his 14 weeks programming project. All parts of the robot were hand made and programmed by Hj Isyrah himself in the Robotic Lab in UBD.

The robot represents a multidisciplinary project demanding programming, electronic and mechanical skills. The robot incorprates various technologies including computer vision, artificial intelligence and robotics. Equipped with a webcam, the robot uses its electronic eyes to recognise and register the initial state a scrumbled 3x3x3 Rubik's cube. The 9x6 pieces or facelets on the cube are modeled in various representations optimised for fast permutations. A two-phase IDA* search algorithm is used to reduce number of moves and to arrive at optimal solution with minimal resources. Through USB connectivity, the IDA* search algorithm is sent to the robotic arm to control the movement of the robotic arm to physically solve the scrumbled 3x3x3 Rubik's cube.

With his victory at BICTA, Hj Isyrah Fahmi will represent Brunei at the Asia-Pacific ICT Award (APICTA) to be held at Kuala Lumpur, Malaysia.

Visiting academic schemes

There are now available visiting professorships, adjunct professorships, adjunct associate professorships and adjunct lecturers schemes. These are equivalent to other reputable university schemes.

Further information can be obtained from the dean of your faculty or UBD website.

Research Clusters

Research Cluster	Cluster Leaders
Materials	A/P Dr Peter Hing peter.ng@ubd.edu.bn A/P Dr Tan Kha Sheng Khasheng.tan@ubd.edu.bn
Energy	Dr Lim Chee Ming cheeming.lim@ubd.edu.bn Dr Sathyajith Matthew sathyajith.mathew@ubd.edu.bn
Modelling and Simulation	Dr Saiful Azmi Hj Husain saiful.husain@ubd.edu.bn
Environment and Sustainable Development	Gabriel Yong gabriel.yong@ubd.edu.bn Dr Bill Duane william.duane@ubd.edu.bn

Science, Technology and Society	Alistair Wood alistair.wood@ubd.edu.bn
Ageing	Dr Oduola O. Abiola Oduola.abiola@ubd.edu.bn
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Cancer	Prof Mohd Mabruk mohamed.mabruk@ubd.edu.bn
Islamic Studies	Dr Hj Ibrahim bin Hj Abd Rahman ibrahim.rahman@ubd.edu.bn
	Dr Hj Ramlee bin Hj Tinkong ramlee.tinkong@ubd.edu.bn
Youth	Dr Dk Norulazidah bte Pg Hj Omar Ali norulazidah.omar@ubd.edu.bn Prof Dr Keith Wood Keith.wood@ubd.edu.bn

If you are interested to contribute to any of the cluster, please feel free to contact them.