AUSTON RESEARCH NEWS

2nd Edition, July 2009

1. **Editorial**

In the universities, we are dealing with brilliant students, but at Auston Institute of Management & Technology we are dealing with humble polytechnic graduates who after a short 5 year spell in industry never stop amazing us with their maturity and clear thinking. We plan to recruit Research Fellows at the Auston Research Centre with special niche research areas to cultivate the research trait of our students.

Two niche research areas are being pursued (1) Medical electronics and (2) nanosecond technology. In fact, Auston Research Centre is inviting a leading research expert from a Korean university to give a public lecture in Singapore in October 2009 on a topic entitled:

"Magnetic Resonant Imaging Through Nanosecond Technology".

The date and time of the public lecture will be announced later.

Contract Research

We are glad to announce that we have been commissioned a contract research on Biomass Reactor with support from a German research company and that we are currently negotiating for a second contract research on energy conservation with nanosecond technology with support from a Japanese research company.

Biomass Conversion To Bio Gas

Our client, a fortune 500 company, collects a huge volume of palm oil waste, primarily empty fruit bunch (EFB) and palm oil mill effluent (POME). An experimental biomass reactor is being designed to handle 50,000 metric ton per year of EFB with 150,000 metric ton per year of POME to produce biomass gas for electricity generation of an estimated 4.4 MW.

This renewable energy will be eligible under the CDM Kyoto agreement to receive CO2 certificate over an initial period of 7 years after installation.

The more interesting is that the payback period of this project is less than 2 years.

Energy Conservation With Nanosecond Technology

Our client has a 100 MW diesel engine in his mine, located at a mountain plateau some 2000 metre above the sea level. Diesel fuel will have to be pumped up from the sea level at great cost. Our solution is to use nanosecond technology to treat the diesel fuel and to mix the solution with 15% of water, since our Japanese research company has proven such combination has the same thermal capacity of an ordinary diesel fuel. In other words, there is the potential saving of 15% fuel.

The payback period is of the order of 1 year. Negotiation in this project is on-going.

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STUDENT PROJECT FROM BUSINESS ENGINEERING MANAGEMENT

The Innovative Flapper

The environmental awareness on one of our natural resources, water, is very much needed in sophisticated, educated, and industrialized countries. As population and industrialization is growing up, the need for water is becoming more essential. The world is already alarmed with the availability of clean water. Research has shown that one third of the world's population is lacking in potable water.

Singapore is trying to be self-sustainable by increasing the amount of NEWater injected into the water pipeline. The NEWater required complex and expensive equipments for the water treatment.

An average person uses 50 gallons of water per day and toilet usage consumes the highest at 38 percent. With this in mind, a group of students in 318MFT has selected to develop the INNOVATIVE FLAPPER(toilet flapper), a moving part of flush valve, sealing water into the tank and allowing water to exit the tank when flushing. It is the water exit control component of the toilet system

The older toilet flapper only closes after all the water in the flushing tank is flushed. The **innovative flapper** releases air – bubble and allows the water to flow into the bowl much faster. When the air is released, due to gravitational force (so the flushing pressure will be great) the flapper closes immediately. By which, the consumption of water is reduced by about 30 percentage, and the user will save on the expensive water bill.

Figure 1 shows the working prototype of the Innovative Flapper developed by the students.

Fig. 1

3. **Student Project From Power System Assignment**

Remote Design Of A Ship Engine Monitoring System

A ship owner in Africa required an engine monitoring and management system, and our student was assigned to do the remote design in Singapore.

The ship had a Caterpillar 3306 engine with a 24 V d.c. closed loop system. The engine drove an alternator to charge 2 x 12 V d.c. 200 Ampere/hour batteries for all lighting and starting of the engine. These instrumentations at the ship were all mechanical, with no alarm indication on the wheel house for any low oil engine pressure or overheating.

The client required a visual and audio engine monitoring and management system from the engine room to the wheel house. Engine rpm, engine oil pressure, gear oil pressure, water temperature and alternator charging amperes were required. The engine must be able to be started from the wheel house from the engine control panel.

The challenge on this project is that the ship was in Africa while the student designer was in Singapore. The only information was from the engine spare part manual and picture of the engine. We had to locate where the sensors and switches were and we had to build the engine simulator in Singapore to study the functions of the sensors and switches for indication and alarm.

System Simulation

Testing of the sensors and switches was really a challenge, with rounds of meeting and brainstorming with the teaching staff. The following-tests were decided on:

No.	Description	Mode of Test	Results
1	Water Temperature	Metal Tin heated with Bunsen burner	Positive
2	Oil Pressures	A conventional grease gun	Busted a few diaphragms, but got it finally
3	Ammeter	Tested forklift's alternator	Positive
4	Inductive Speed Sensor	Placing it need an 1800 rpm bench drill	The distance from the tip of the sensor to the drill's chuck was a bit tricky, but got it at last after some research

Circuitry Design and Component Layout

Due to the lack of technical knowledge and expertise of the client, we had to design something very layman and easy for them to trouble shoot if problem should arise out at sea. It must be easy for them to explain to us so we can help them here. Therefore intensive use of electronics or PCB board was out of the design. We designed the circuit using fuse, control relays and buzzers, very much like the system of a conventional forklift.

Our main protections for the circuit were 2 automative fuse boxes that holes 7 fuses each. These were then connected to a series of control relays for the alarms.

System Integration

After the individual confirmation of the individual wiring for the main battery supplies, sensor, switches, lightings and buzzers, putting everything together was pretty smooth except for the soldering of the 24 core cables onto the 27 pins connectors, which terminals were very close to each other. We hooked up the entire system with proper marking in the junction box as well as the control panel for system testing.

Testing and Trouble Shooting

Like all first time tests, there would sure be some problems evolved. We had some malfunction readings but checking the soldering on the connectors solved most of them. Except for one critical one, the tachometer from the junction box did not synchronise with the tachometer on the wheel house panel. We swapped them around, changed the sensor. Nothing worked. After understanding how an inductive speed sending unit worked, we countered the problem by using few silicon diodes to control the flow of current, thus solving the problem.

Commissioning

After system acceptance by the client, we delivered our Caterpillar 3306 Marine Engine Monitoring and Management System. The clients fixed up everything on the ship with the help of the instruction manual. Everything started and ran smoothly till this day.

4. Correspondence

Welcome to Academic Research

Professor Chen has kindly given me the opportunity to contribute to July's edition of Auston's Research News, and I welcome this chance to offer this article to the publication. It is aimed at Undergraduate students of Auston who perhaps are reading the Research News as a prelude to the research opportunities that they may have whilst studying for their degrees at Auston AIMT.

As you know, from July 2009, AIMT have introduced an updated set of Honours Degree programmes that they operate in conjunction with Coventry University. The new Engineering and Computing programmes include Honours degrees in Computer Science, Network and Mobile Computing, Logistics, Business Information Technology, Computer Network and Communications Technology, and Electrical and Electronic Engineering. They cover many of the latest techniques that are current today in the world of Engineering and Computing technology.

What these diverse degree titles have in common is a compulsory individual academic research module A303EC Individual Project. This module introduces students to research and it is usually the first formal academic research that undergraduate students undertake. Therefore I thought it appropriate that I share my experiences of academic research projects with you as I was for 5 years the project coordinator at Coventry University. It was my role to approve projects subjects, titles, schedules and appoint an appropriate supervisor to oversee each project. Every undergraduate student has to complete a research project as a condition of the honours degree programme, but equally each undergraduate has to learn how to conduct academic research, and I would hope that this article goes some way to alleviating the fear that I know many students have when undertaking academic research for the first time.

So, let us take a look now at what the module A303EC contains. The module describes the project as...

... A *major individual study at Honours Level in a subject related to the degree award.*

What this means is that students who are studying for a Computer Science degree for instance, will undertake a project that is related to the subject of Computer Science, students studying Business Information Technology will undertake a Business Information Technology related project and so on. It is a major individual study because a student undertaking a project is at the pinnacle of their undergraduate studies of a particular subject, therefore they can use all of their knowledge gained on the course to full effect.

The description goes on to say.....

....each project must be unique and will therefore vary in scope and emphasis.

This sentence can give students many sleepless nights in my experience. The project has to be unique as it is an individual piece of work, that is, it must be your own work. Finding a unique project is not easy but here are a couple of tips.

1 Choose an area of your subject with which you are specifically interested.

2 Look at the project titles that have been completed in the past, there will be a list of past projects available. The titles will help to generate some ideas for projects that you can tackle.

Remember, you do NOT have to be an expert in the area you have chosen for your project, as one of the criteria for doing the project is to improve your knowledge of a particular subject.

The description continues with.....

....*Projects are expected to be a substantial practical problem-solving exercise or a research study....*

Many students find this part of the project description particularly daunting, but it should not be, as I will explain. All honours degree projects should be a real project with a practical element to them. The ..... *substantial practical problem-solving exercise* ..... may mean for some students, a practical computer programming task, such as developing a new software app for a mobile phone, or a new software application for a business to use, or improving or updating an existing software application that your employer uses. If on the other hand, you do not have the skills or inclination to carry out this type of project, then you can consider completing a research study.

A research study for some students can involve them in investigating, that is researching into, particular aspects of an area of their degree subject. For instance, a Business Information Technology student could carry out a research project into a possible business model for making users pay for sending emails, or perhaps research into how to lower the carbon footprint that world-wide email use is thought to generate. The practical aspect of the research could be to publish an industry-wide management report on the findings that you have concluded, or perhaps publishing your findings in an academic paper in conjunction with your project academic supervisor. The main point about this type of project is that you can still have a practical outcome even though you are conducting a research project.

Finally, the last sentence of the description details the skills needed to successfully complete the project on time and to the required standard.

.....*which require students to demonstrate their skills in organisation, time-management, investigation and communication.....*

In practice, these skills are the taught part of the project. There will be lectures at regular interviews covering time management, research techniques and effective report writing spread throughout the study period of the project.

In conclusion then, A303EC is a perfect introduction to undergraduate academic research, from which you can take your research career forward to who knows what heights.

Happy researching

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