UniTI Newsletter

Forging Relations between
Indian Universities and
Texas Instruments

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In a survey sent out to a mix of faculty, students, and design professionals from India, close to 50% of the respondents felt that the curriculum should be designed with help from the industry. In the same survey, a large number of participants felt that guest lectures from industry are essential. There is also a big requirement for student internships in India, which is much more than what the industry can possibly meet. Summarily, there is a perceived need for an "industry experience" in the student community, but the demand is larger than supply.

Internet resources can be a big source of help to fill this void. If you need information on products made by a company, it is available on the Internet. I don't think colleges stock product literature in the labs any more! There is also a great deal of freebie software, hardware, and courseware available on the Internet, if you have the patience to explore.

I wish to quote the "Analog eLab" as a case in point. The eLab is a series of webcasts, which focus on real-world applications and are hosted by experts from Texas Instruments, TI's distributor partners and third parties. I suggest you begin by looking at the selection of videos available at http://tinyurl.com/m7cchl. The last time I visited this site, I found close to 80 videos; each of these runs anywhere from 30 minutes to an hour. There is a short video on "Nuts and Bolts of the Delta-Sigma Converter" which you may find interesting – it is a class-room style exposure to Delta Sigma analog-to-digital converter by an industrial professional. There are many other lessons which relate to how components must be selected. For example, if you are considering teaching a few avant garde classes on LED lighting, you will find excellent tips here on how LEDs should be selected, the benefits of LED lamps over halogen lamps, the amount of power reduction possible through LED lighting, how LED lighting is easier to energize through solar energy, etc.

If you prefer reading journal articles and learn from them, I would like to bring to your notice the application journals that are free of charge. An example is the "Analog Application Journal" that will be sent to you by e-mail if you register your name at the website. The latest version of the journal and the archived publications can be accessed from the link http://tinyurl.com/cqxyta

If you wish to provide your students with an exposure for "industry think," you may want to consider the Web Logs ("blogs") written by experts. Texas Instruments Principal Fellow, Gene Frantz, occasionally writes blogs at http://blogs.ti.com/ There are also discussion groups and a whole community of fellow-professionals who interact at http://e2e.ti.com/

I know you must now be getting worried about the sea of information that is out there! As a teacher, it may be comforting to you that your students are reading technical literature in their spare time and not anything else! In fact, there are devices available in the market today that will allow you to find the above content on a Television. It would be a dream come true for a professor to recommend a video on the "Analog" channel and an audio lecture on an "MCU" channel in an educational TV network! Surprisingly, technology is not the limiting factor in making such a dream true.

C.P. Ravikumar

Batteries not included!

C.P. Ravikumar

"Batteries Not Included" is a "small print" that electronic product sellers have included on the boxes for many years. Steven Spielberg and Matthew Robins also made a science fiction film with the same title. The plot revolves around an old couple who are running a failing restaurant; their only son has died in an accident. The couple get unexpected help from an alien species that can rebuild things from scrap. What is more, these aliens derive their energy from scrap – they don't need batteries to do their work! Perhaps we are a step closer to fiction today, with energy harvesting in electronics becoming a reality. While it would be certainly an exaggeration to say that applications such as electronic games will run without batteries and harvest energy from their surroundings, there are new applications where this would be possible. While "powerful" 32-bit and 64-bit multicore processors can be "hot" and help deliver high performance for graphics needed in electronic games, they can also be energy guzzlers; some of their 8-bit and 16-bit counterparts are being considered "cool" for the way they manage power. The ultra-low-power microcontrollers from Texas Instruments achieve a level of processing efficiency that many applications no longer require traditional batteries. These applications include wireless sensor networks that may involve sampling various sensors and communicating wirelessly. Since wireless sensor networks must have "infinite" life-time, energy harvesting is perhaps the only way they can be powered.

Battery Technology and Embedded Processing

Batteries such as lithium-ion cells have been used to power mobile electronics for several decades. However, the undesirable impact of batteries on the environment is well known. Innovations to improve the life time of batteries continue to take place, but the power efficiency of batteries has not kept pace with that of electronics. While Moore's law predicts doubling of device densities every two years, battery capacity doubles every 10 years. Earth-friendly batteries, such as bionic batteries, are also being developed. For example, Prof. Angela Belcher of MIT is using viruses to grow nanowire electrodes required in bionic batteries. The weight of the batteries is another concern – to generate about 200 Watt-hours of energy, the weight of the battery must be about 1 kilogram. We certainly do not wish to carry the batteries for our mobile phones in suitcases. For applications such as wireless sensor networks, such solutions will be infeasible.

Unconventional sources of energy, such as solar energy, wind, or vibration, can help generate very small amounts of energy in a given time. For example, the harvested power from outdoor Sun light is as 100 mWatt/sq-cm at 100% energy conversion efficiency. This means if you have an 8cm x 4cm solar panel that is 100% efficient, it may generate 32 Watt-hours of energy in 10 hours. Energy efficiency of panels may be lower in reality due to dust, etc. If indoor light is used, there is a 1000x reduction in this energy. When vehicles are driven on bridges, they vibrate; the energy from vibrations is about 800 microWatt/sq-cm. Radio frequency emissions such as GSM and WiFi also have energy in them, but the power that can be harvested is only 0.1 microWatt/sq-cm (GSM) or 0.001 microWatt/sq-cm (WiFi). To be able to use these, the electronic systems must be able to operate on small voltages and must be highly energy efficient. Let us consider the main sources of power in an embedded application:

➤ "Digital" power - Gene Frantz, Principal Fellow of Texas Instruments, has made a simple law to predict the energy efficiency of digital systems - roughly every 18 months, digital systems designed using the new CMOS technology will require half the power to deliver the same MIPS. This is possible due to better power management techniques that VLSI designers have invented (and continue to improve) over the years. The MSP430 16-bit microcontroller has active power consumption in the range ~200 µA/MIPS and standby current smaller than 1 µA. The MCU operates at speeds that are modest (< 25 MHZ) and draws small peak current and simple power supplies are sufficient. It is therefore ideally suited for applications such as tamper-proof energy meters that need to be sealed and powered for tens of years.
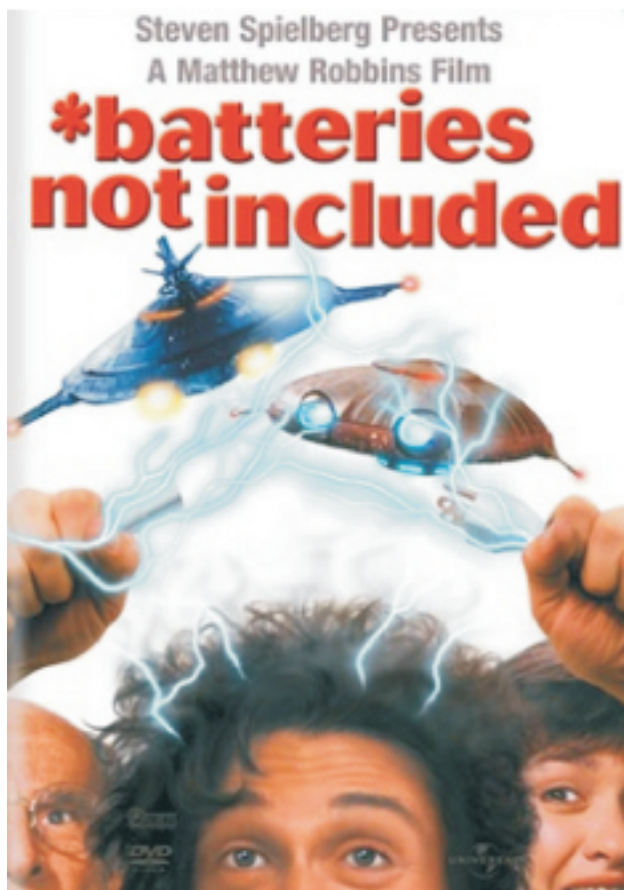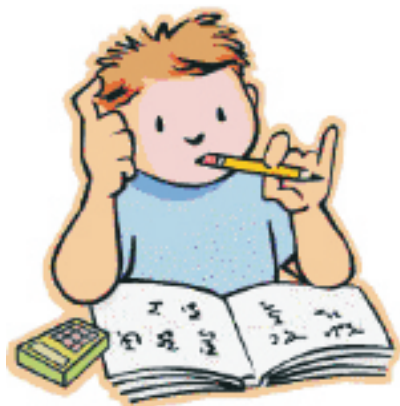
- ▷ "Analog" power – Analog circuits such as ADC, DAC, amplifiers, etc. draw power continuously from the supplies. Mixed-signal processors such as the MSP430 are built as "SoC" and integrate analog circuitry and digital circuitry onto the same device. With the help of a low-power fabrication process and special analog design techniques, even the analog power can be brought down significantly.

As a result, applications built around low-power "mixed-signal" processors such as MSP430 can depend on "micro energy harvesting." The energy harvester requires a means to convert ambient energy into electrical energy and a way to store the energy for later use. The storage of energy can be done on Lithium-ion batteries, thin-film batteries, or "Super Capacitors." Researchers are presently looking at new applications that can use the small amount of energy available from energy harvesting. A wireless sensor network embedded into a bridge to monitor its structural properties is an example where energy harvesting can be a natural choice. Even in applications where conventional batteries are available, energy harvesting can be used to extend the life of the batteries.

India is largely an agricultural country and most Indian farmers rely on the monsoons for irrigating the farms. Wireless sensor networks can help farmers monitor the moisture content in the soil and decide on irrigating the fields in a smarter way. Researchers have also been considering using wireless sensor networks to predict natural disasters such as a Tsunami or a volcano eruption. Such networks can be powered using solar energy harvesting. There are also medical applications where the body temperature can be used to power the implanted electronics. A course on Wireless Sensor Networks, based on the eZ430RF2500, is available at the "Connexions" site – see [3]. More information on the eZ430RF2500 wireless development kit is available from [5]. Information on a solar energy harvesting kit from TI is available from [4].

Exercise 1

An embedded system is being used for monitoring the moisture level in the soil. Assume that a message is sent every 1 minute. The system is normally in sleep mode, when it draws 1 microampere current. When it wakes up, the current ramps linearly from 1 microampere to 50 microampere in 1 ms. The system remains in active state for 5 ms during which it sends a wireless message; after this, the system reverts to the sleep mode. The current drops linearly from 50 microampere to 1 microampere in 1 ms. Assume that throughout the active period, the supply current is 50 microampere.

- ▷ Find the average current consumption and the average power consumption. Take the system power supply to be 1.5V.

- ▷ Assuming that solar energy harvesting is used, what is the size of the solar panel that would be necessary if the harvester should be capable of providing the average current found in (a) at all times?

- ▷ Note that solar energy may not be available at all times. What solutions do you propose to solve this problem?

- ▷ Generalize the solution for (a) for a standby power of Is, active power of Ia, a standby period of T_s, an active period of Ta, a ramp-up/ramp-down time of $\triangle$.

Exercise 2

In this exercise, we will illustrate the importance of an embedded processor that can work on small amount of harvested energy. In the above exercise, if the embedded system draws 10 microampere in standby mode, and 1 milliampere in the active mode, has a ramp-up/ramp-down time of 1ms, what would be the size of the solar panel that would be necessary? What is your learning from this exercise?

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1 Chris Edwards. Bionic batteries. IET Magazine. May 5,2009. Available from http://kn.theiet.org/magazine/issues/0908/bionic-batteries-0908.cfm

2 Adrian Valenzuela, Texas Instruments. "Batteryless energy harvesting for embedded designs," Embedded.com, August, 2009.

3 Thomas Watteyne. "eZWSN: Experimenting with Wireless Sensor Networks using the eZ430-RF 2500," available from "Connexions" http://cnx.org/content/col10684/latest/

4 Solar energy harvesting kit from TI enables permanently-powered wireless sensor networks. http://www.cymbet.com/MContentA/pdfs/release-090119-cymbet-ti.pdf

5 MSP430 Wirelss Development Tool. http://focus.ti.com/docs/toolsw/folders/print/ez430-rf2500.html

Designing Eco-friendly Products and Technologies – A Debate

Harinath Renukamurthy, TI Germany

In the recent past, there has been a focus on developing environmentally friendly technologies and products. Terms like green technologies and sustainable technologies are becoming common place. The reason is very simple. About 200 years after taking up the path of industrialization, people around the world are realizing the ill-effects of the same on nature and mankind. Forest cover has depleted, quality of air and water has deteriorated, the diversity of flora and fauna has diminished, conventional energy sources are becoming scarce, climate across the globe is changing in unforeseen ways and even multitude of different human cultures are gradually vanishing. In short, over these years of rapid developments in science and technology, there is enough evidence to say that life-styles around the world have changed so drastically that we are pushing ourselves and the world around us to a dead-end. It is in this context that focusing on development and adoption of eco-friendly technologies and products has become the need of the hour.

In the context of environment it is common to talk about sustainable energy sources like solar and wind, bio-products, products made with recycled material, fuel efficient vehicles, low power design, etc. While pursuing these objectives is imperative, one must realize that they are not sufficient to avert an environmental disaster. In this context I have touched upon three ideas called "absolute energy minimization", "focus on life after death" and "principle of non-violence."

Absolute Energy Minimization

The term energy minimization is not new at all. It is a goal in most electronic designs. However, we need to take a slightly broader view to see if this objective is being addressed at every stage.

Much of the things around us are indeed designed to minimize cost and not energy [1]. Saving cost or money at every stage of production and product use is given utmost importance. Many people argue that pursuing cost minimization is a noble goal since that would automatically result in optimal usage of people, resources and energy. Does energy also get minimized when the cost of a product is minimized? Two simple examples are taken here to illustrate that this is not the case.

The first example is to do with a simple daily use item like T-shirt. The cotton may come from Brazil, the thread made, dyed and stitched in India, the chemicals for this process come from somewhere on the planet and finally the T-shirt is shipped and sold to a global customer. Was the T-shirt made with energy minimization as the objective? While cost, as measured in currency, was minimized, maximum energy may have been consumed in the process.

The second example is the integrated chip in a cell phone. The silicon material is imported from Africa or South America. Silicon wafers are fabricated in the fabrication plants located in USA and shipped to Taiwan or Malaysia for testing, slicing into dies, assembling into plastic or ceramic packages and finally shipped back to the USA to be stored in a centralized inventory. The cell phone manufacturer in Europe orders these parts and ships them to a factory, may be in China, where the cell phone is manufactured and shipped back to the US or Europe to put into the hands of global customers. By the time the first call was made on the cell phone by its user, the integrated chip inside the phone made two voyages around the world. Would you call this a low power design?

What we really need to minimize is absolute energy, measured in physical units like Joules - see Figure 1. As an exercise, I would like you to back trace every product that we touch or use in our everyday lives and find out from where the ingredients have originated.
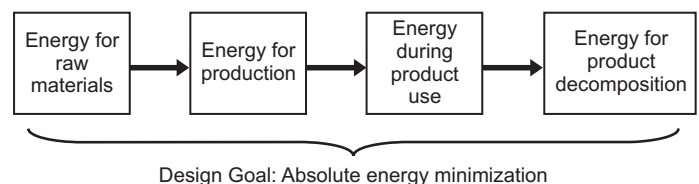

Design Goal: Absolute energy minimization

Figure 1 - Energy Minimization

Life after Death

Almost every product that we use today is designed to meet the needs of the end-customer. Customer satisfaction is the top most goal of every company. Success is declared when a customer is happy and pays the amount the company desired to charge.

There are unresolved problems after customer satisfaction was achieved. All products have a finite life time – some products may last for months, others may last for years. What is to be done to the product after it reaches the end of its life? Product designers, manufacturers, and salesmen may have given no thought to this. Materials have to go somewhere and unfortunately in our grand scheme of industrial society there is no where to go [2].

If you are thinking of recycling, let us recall the second law of thermodynamics, which states that entropy in the physical universe always increases. Things always go from orderliness to disorderliness; bringing back any

kind of order in a finite system would mean spending more energy. In majority of the cases, we don't know how to handle life-after-death. Since life-after-death was never the main design objective, it is almost impossible to separate a product into its original ingredients. This is how we end up with so much of plastic, nuclear waste and poisonous chemicals which have no place on earth and have started threatening the complete bio-sphere.

The principle of non-violence

Let us redefine "violence" to mean irreversible damage done to not just human beings but also plants, animals and any part of our biosphere. I will illustrate how industrial societies have been historically very violent in nature by way of a few examples.

History tells us that entire cultures have been eliminated to pave the way for industrial societies. Forests, hills, water resources, animals species have all been sacrificed. The extermination of the living bio-sphere around us in such a systematic way is what is considered as violence; our design methodologies need to adopt principles of non-violence in bringing out products and technologies [3].

Is there any physical law that prevents us from incorporating these principles into designing products and technologies? Is it really possible to minimize energy? Is it possible to recycle 100%? Can things be setup to minimize violence? Surprisingly nature shows us that it is possible to minimize energy and violence and to recycle things 100%! Water and air are 100% recycled. All biological life-forms are designed with life-after-death principles. There is nothing called waste in nature's factory. Every process is organized such that it takes place at absolute low energy conditions! Isn't there a lot to learn from Nature as a designer of products and technologies?

Summary

I briefly touched upon 3 principles namely, "absolute energy minimization", "focus on life-after-death" and "principle of non-violence" as three areas that need focus when developing environmentally friendly technologies. These principles can be seen in every aspect of natural processes. Indian philosophy and traditional Indian lifestyle had evolved around these principles. It is time that the present generation revives them to re-design the world for the future. Suggested further reading:

▷ "For the Common Good" by Herman Daly

▷ "Cradle to Cradle" by McDonough and Braungart

▷ "Earth Democracy: Justice, Sustainability and Peace", by Vandana Shiva

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Creating the local eco-system for manufacturing – Challenges

Is local manufacturing of products, which Harinath promotes as an "environment friendly" alternative, always easy? We would like to hear your opinion on the topic. UniTI spoke to a few industry persons who have dabbled in manufacturing electronic goods to understand the challenges. While "Made in India" garments and shoes have achieved a brand value in the global market, much has to be done to achieve the same status for electronic goods manufactured locally. Establishing fab units for manufacturing nanometer integrated circuits requires huge investments, of the order of billions of US dollars. Some of the problems that face the PCB manufacturing industry are,

▷ Shortage of BGA and micro BGA assemblers

▷ Soldering is manual and automated/machine based is very costly

▷ Taxation tends to increase the cost

▷ Small scale manufacturers have very little or no subsidy

▷ No eco-system for manufacturing

▷ Several key components such as connectors and inductors have to be imported

▷ Technical challenges – technology lacking for implementing micro via and buried via for small pitch integrated circuits

Will the availability of "open source" platforms such as Beagleboard help in addressing the problem? The "open source" nature of these platforms allows anyone to be able to manufacture the boards – the technical information necessary for manufacturing is "open" for the public. As a result, "cottage industries" can come up in growing economies like India to manufacture products based on such platforms. As an example, imagine that a graduating group of students from a college wish to start a company in the incubation program. They have developed a prototype of a product for an interesting application and would like to manufacture small quantities of them to sell in India. A low-cost board costs X when ordered directly on the website, but shipping charges and import duties quickly add up; as a result the cost of the board jumps to 2X. The cost of the product would therefore look less attractive to the end-customer. Time to market is of essence in some of the innovative products. Delays in importing the boards can have a devastating effect on the student venture. Manufacturing the board in small quantities locally may not provide the cost benefits of mass manufacturing, although it will eliminate the shipping costs. Since some components such as connectors and inductors need to be imported, there may not be a big reduction in time-to-market or the import duties.

A day at the Leadership University

C.P. Ravikumar

On June 26, 2009, an Expo was held at the Centre of Electronic Design and Technology (CEDT) at the Indian Institute of Science (IISc) to showcase the research projects carried out in the Centre. IISc is Texas Instruments' "Leadership University" in India. Known as "Tata Institute" to the common Bengalurean, IISc was established 100 years ago by the visionary J.D. Tata as a research institution par excellence.

The CEDT, which houses the activities of the TI Leadership University, has had a "TI Lab" for 10+ years where a number of projects are carried out every year based on TI semiconductor. In the CEDT Expo 2009, several projects based on TI technology were on display. The expo was inaugurated by Dr. V. Prakash, Director of Central Food Technology Research Institute (CFTRI, Mysore). He was highly appreciative of the student projects and felt that several projects can find direct applications in food industry. This certainly gives us all food for thought!

Sixteen projects were demonstrated at CEDT Expo [1]. Among these, four projects were based on TI technology. I have covered two of these projects in somewhat more detail. The CEDT Expo 2009 is conducted like an "Open House" event and everyone is welcome to attend. The students had put up attractive demonstration booths and were busy explaining their projects to visitors.

Students demonstrating their projects at CEDT Expo 2009
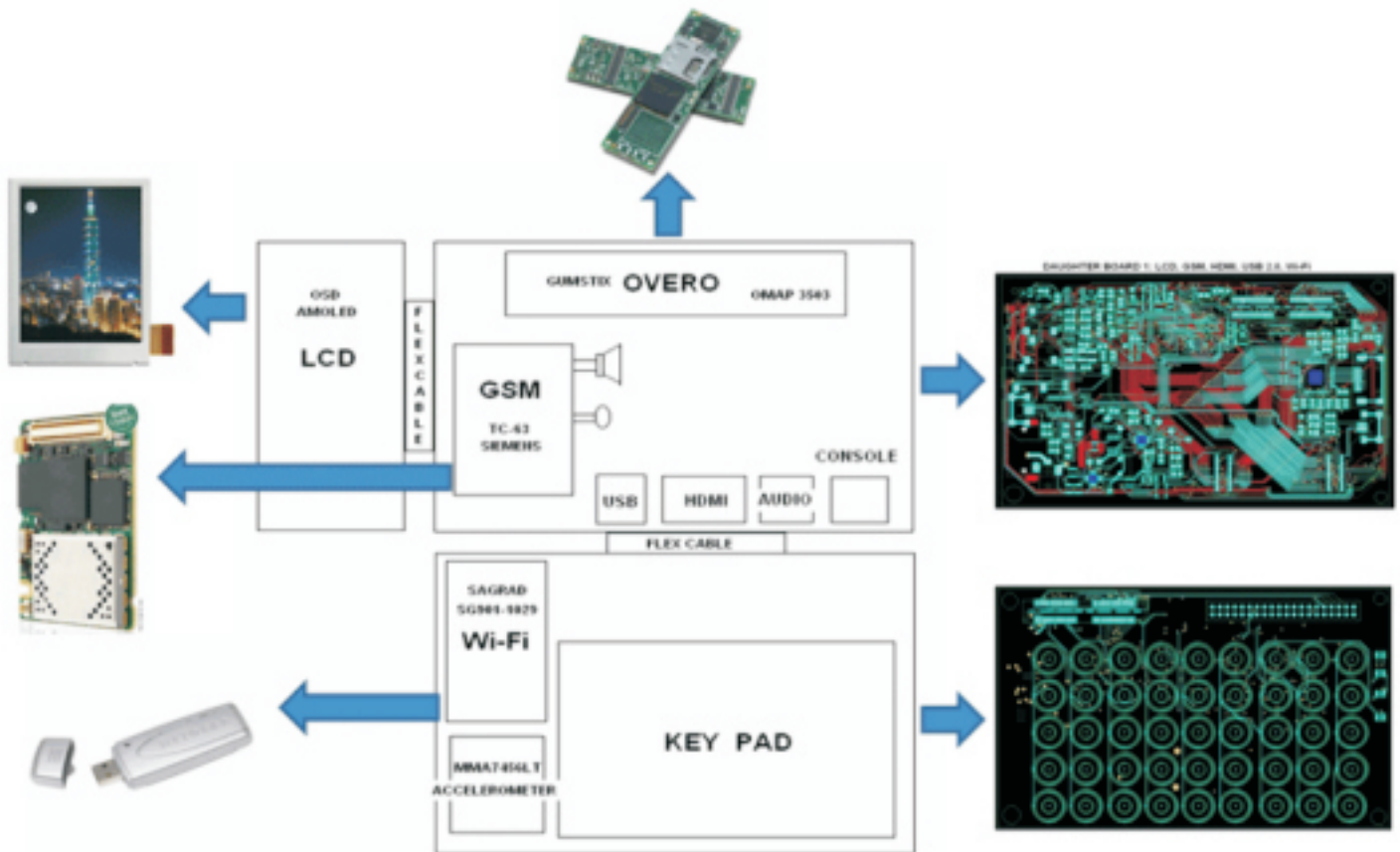
Low Cost Computing

This project was carried out by Vinay NS and Shashidhar L, students of a Masters' program offered by CEDT. The project was supervised by Prof. H.S. Jamadagni and Mr G.V. Mahesh. The aim of the project was to build a low-cost computer based on the Gumstix board, which is in turn based on TI OMAP 3530 SoC, which includes an ARM Cortex-A8 processor core and a NEON co-processor. Gumstix is a "Single Board Computer" developed by Gorden Cruberg as a hobby project; it is now available for open source community interested in developing products around the board. "Gumstix" derives its interesting name from its size and shape, which reminds us of a stick of gum (see the adjoining figure).

Gumstix single-board computer is as small as a gum stick

The CEDT low-cost computer (see figure below) aims to integrate computation and communication functions in the same device. It uses a Quad Band GSM for SMS and Voice Calls and a Netgear dongle for Wi-Fi connectivity. While it supports a low-power 4.3" OLED based display, it also provides a slot for connecting an external display through HDMI. The computer runs Angstrom Linux which supports a host of office applications.


Organization of CEDT Low-cost Computer based on Gumstix board

Home Security System

Vinay Shirahatti and Deepak Kumar Dohare, students of M.Tech program in CEDT, have built a home security system based on Beagleboard. The project was guided by Prof. H.S. Jamadagni, Prof. N.V. Chalapati Rao, and Prof. Jagannath Rao of CEDT. Two units are installed, one indoors and another on the door, to provide the residents security against intruders, gas leakage, etc. Each unit uses the Beagleboard. The indoor unit is connected to a television and the on-door unit is connected to a camera and a motion sensor. Pictures of person(s) at the door are flashed on the TV screen as a warning to the residents who may be busy watching television. WiFi connectivity is used between the indoor and outdoor units. A GSM unit connected to the indoor unit is capable of sending an SMS to the home owner if an intrusion is detected by the motion sensor. A finger print sensor attached to the outdoor unit is capable of providing access to only the authorized persons.

Beagleboard is a development board based on OMAP 3530
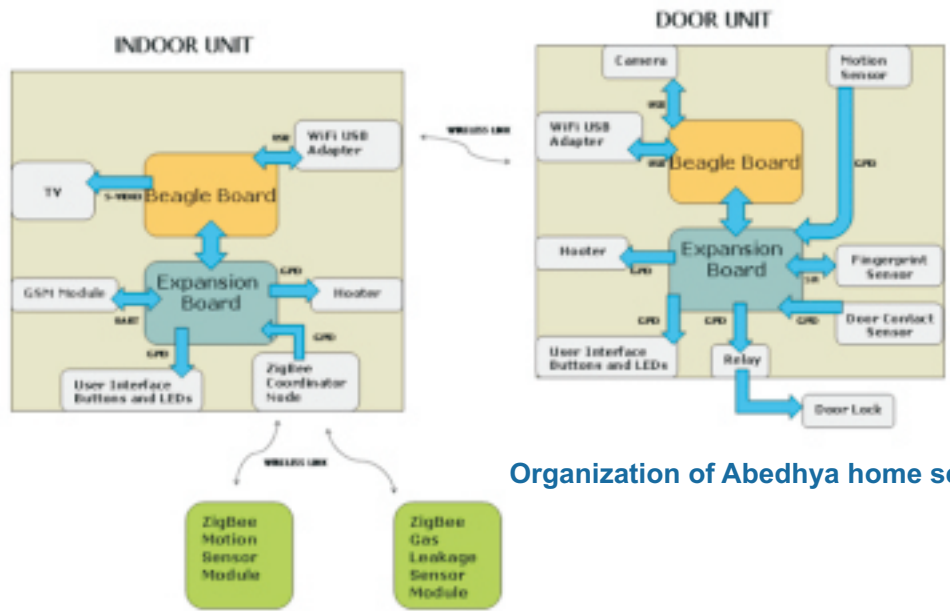
Organization of Abedhya home security system from CEDT

References

1. http://tinyurl.com/ltfckq - Links to projects demonstrated at CEDT Expo 2009 are available here

2. http://www.gumstix.org/ - This is the Gumstix developers' site

3. http://beagleboard.org/ - This is the Beagleboard developers' site

Demonstration of "Home Security" Project

Art by Ananya Ravikumar

*"Mo(o)re to study every day …
How will miniaturization help the school kid?"*

Art by Ananya Ravikumar

"Green Invention #3635: A solar powered umbrella that also charges my mobile phone"
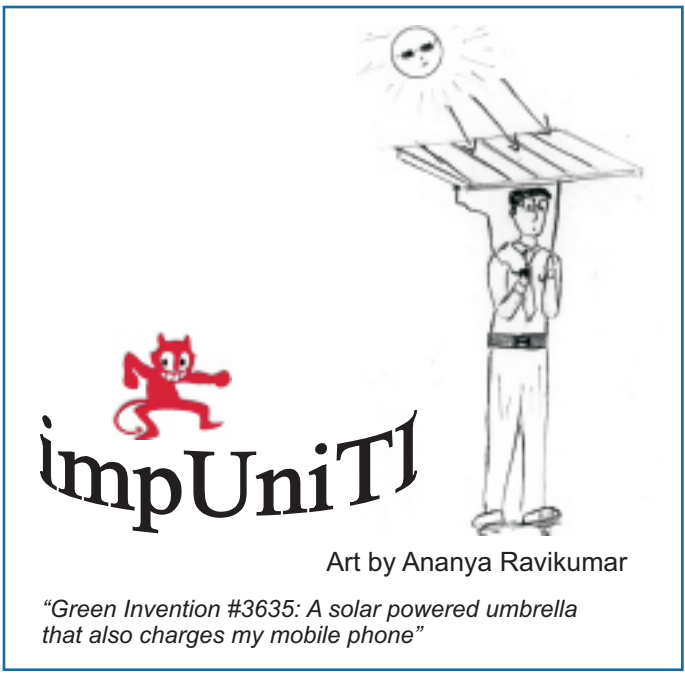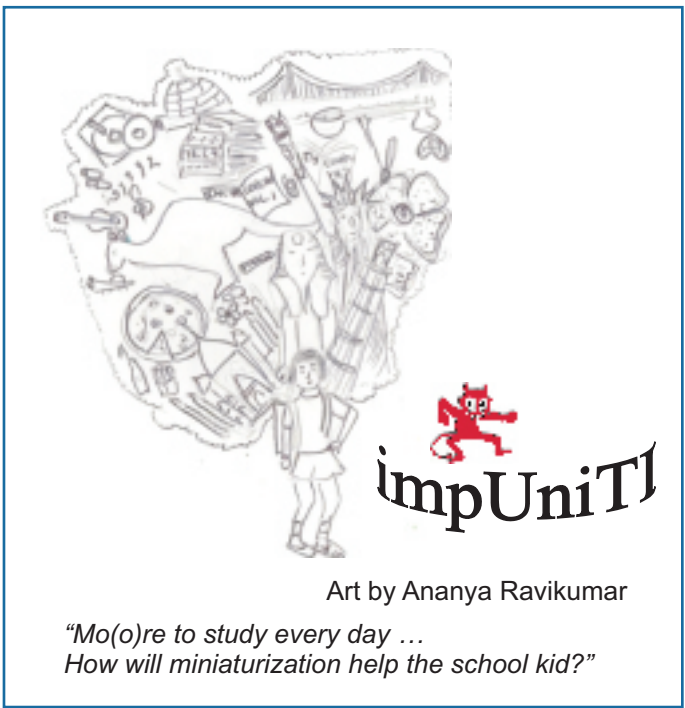
Technology for the teachers – Part II

C.P. Ravikumar

During a meeting at a prestigious Indian academic institution, a senior faculty member began to write in long hand on a chalk board when he had to explain a technicality. One of my colleagues remarked later that the sound of chalk on the board brought back pleasant memories from his childhood. You may have noticed that even in present-day movies, it is the chalk board that is often associated with the quintessential Professor! Yet, many Indian Professors I know are fast adopters of the latest technologies – I see them carrying the latest and the most handsome and compact laptops!

The introduction of multimedia in the classroom has opened up several possibilities for the teachers. I know some Professors who use tablet-like devices on which they write in long hand and the text they write gets projected on the screen. The Professor may also be able to provide these notes to the students later. This system may be a blessing for a Professor when the subject involves a lot of mathematical formulae. Typesetting math into foilware can be a daunting task. I have even seen a system that recognizes the characters being written in long hand and coverts them into computer text in real-time. Graphical items such as figures, of course, are preserved as is – a more advanced system would also attempt to redraw the pictures scrawled by the Professor into neat diagrams and color them!

Multimedia technology can also help the student. It is not easy to listen to a lecture and simultaneously make notes. When I was a student at the University of Southern California, some International students, whose native language was not English, would record the lecture on audio tapes. Today, a student would be able to record both the audio and the video portions of a lecture. Some lecture theaters are fitted with recording equipment. Imagine an advanced system that can convert an audio lecture into notes for the students!

Marking the attendance is a useful exercise when the class is small. Like many other teachers, I use the opportunity to look at the students and make myself familiar with their names. However, when the class is large, marking the attendance becomes a tedious task and threatens to take away a major portion of the class time! With wireless communication technology, innovative solutions seem to be appearing for this mundane task. A good solution would save the teacher time and would minimize the chances of "proxy" attendance. An ideal solution would be based on smart cameras fitted into the furniture; these would recognize the student and wirelessly transmit the information to be recorded into a database! One can also think of a system which uses camera placed at the entrance to the classroom and permits serial entry of the students, but this method may be impractical for a large class.

Administering a quiz in a large class can also become easier with technology. If the teacher can walk in with a few "multiple choice" questions and transmit them to the devices accessible to the students, the students can in turn send the answers back. For obvious reasons, the system can send out different questions to students seated in adjacent seats. The answers can be graded automatically after the teacher punches in the correct solutions to the quiz. The students may be able to know their grades instantly!

A Professor friend from USA told me about an "open Internet" examination policy that his University has adopted. This is similar to the "open book" examinations that we are familiar with. In a limited time, the students must be able to answer the questions posed by the instructor with any help he may get from the Internet. Making up questions for such an exam and grading them can both be very challenging.

I have also wondered about a speaking and listening map as an innovation in secondary education. I recollect our school teacher walking with an old map of the world. She would hang the map to a nail on the blackboard. (A student had to help her since she could not quite reach the nail on the top of the board.) She would point out mountain ranges, rivers, countries and cities on the map. Unfortunately, only a few lucky students in the front rows could really see the details on the map. Sometimes, a student would be asked to identify something on the map. This was something most of us dreaded. I presume that the situation has changed today, with school children having better access to information. I still think it would be nice to have a map that is capable of highlighting a city or a country as their names are spoken.

A newspaper story from New York Times (Aug 8, 2009) predicts that "In a Digital Future, Textbooks Are History" [1]. The article quotes an officer involved in the initiative, stating that children are digitally nimble, they multitask, transpose, extrapolate, and perceive knowledge as infinite. The traditional text books are perceived as "finite, linear, and rote." It is common to see students carrying computers in many engineering college campuses today. How will the emerging technologies impact engineering education? Would the engineering students of tomorrow learn from blogs, Wikipedia, online courses and twitter feeds? Only time will tell!

References

[1] http://tinyurl.com/la2xsx

Light up the World – An enlightening meeting with Prof. Dave Irvine-Halliday

C.P. Ravikumar

In the July 2009 issue of UniTI Newsletter, we looked at the "Light up a Billion Lives" (LaBL) initiative in India. Since then, we have had a chance to meet Prof. Dave Irvine-Halliday of University of Calgary, who founded the "Light up the World" initiative (LUTW). Prof. Halliday is a proponent of LED lighting as an economical and environment-friendly alternative for lighting in the developing countries. The history behind the LUTW is quite interesting. When he was on a Sabbatical leave to Nepal in 1997, Prof. Halliday noticed the use of kerosene lamps in Nepal, which produced more smoke than light. He found out that the average income of a Nepalese villager is 200 US Dollars. He realized the need for a great need for affordable lighting which is also environmentally safe and has no hazardous impact on the health of people. Prof. Halliday spent most of 1997 and 1998 on producing acceptable white light from different combinations of colored LED. He requested samples of white LED from a Japanese company called Nichia and made a lamp based on the WLED.

In 1999, Prof. Halliday travelled to Nepal with his WLED lamps and tested them in the villages. He was overwhelmed by the response from the villagers and decided to pursue the effort. LUTW was established in 2002 as a global humanitarian organization. With support from individuals as well as organizations, LUTW has brought light to more than 17000 homes in more than 50 countries – from Afghanistan to Zambia.

"My aim is to develop the Toyota Corolla of house lighting," explained Prof. Halliday during our meeting. "Our aim is to reach the base of the pyramid – therefore bringing down cost without sacrificing quality is important. For example, I would not use cheap LEDs that would not last long. I am looking for rugged solutions."

There were several lessons for me from this meeting. Most importantly, I was impressed by the courage of a single individual to dream big and, more importantly, pursue his dream with determination. The fact that a University Professor could be behind such an initiative will serve as an inspiration for many academicians. Finally, I am impressed by his penchant for constant improvement. During the meeting, he showed us the designs of lamps that his students are working on. The genuine concern he showed for the end users – mostly poor families from villages - and the way this translated into product design is also a great lesson by itself.

Prof. Halliday is 67 years young. You can learn more about LUTW from http://www.lutw.org

LED Lighting

LED lighting is ideally suited for directional lighting applications. Examples include lighting used in restaurants and parks. Through LED lighting, one can replace a 20W halogen lamp with a 4W solution. What is more, LEDs last longer (up to 50,000 hours) than a halogen light. LED lighting can be run on DC and this makes it easier to use solar charged batteries with DC/DC converters.

In the article "How Dean Kamen took his island off the grid," published in IEEE Spectrum, September 2009, Sally Adee visits the private island owned by Dean Kamen, a world-renowned inventor. Dean has used innovations such as solar and wind energy harvesting to make the island free from the power supply grid. On his island, he has used outdoor LED light fixtures for mood lighting.
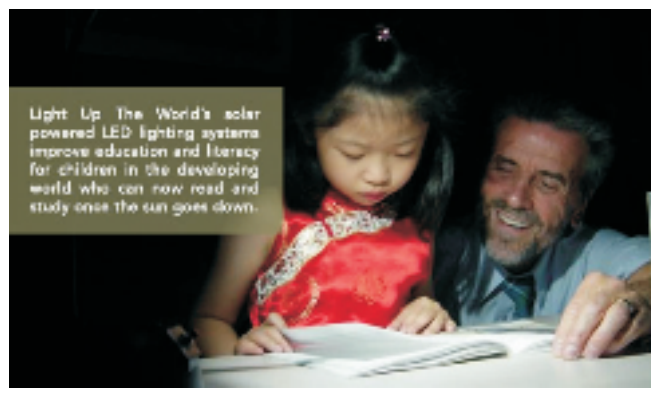
Feedback - Amplifier

Dear Dr C P Ravikumar,

Received the copy of UniTI Newsletter. Great work. Well composed contents.
We are doing a lot of work on the LED Front. We are currently designing and developing products based on LED. We are also working towards replacing Neon Based Sign Boards with LED Sign boards.
We are developing LED Screens and Lighting applications too.
Congrats once again to your UniTI Newsletter efforts.

Thanks and Kind regards,

Mohammed Azad A K
REACHICS

Thanks for the UniTI newsletter – it is wonderful (and not just the first interview !) The mix of news, information, articles and interviews makes it interesting reading – even to me.

Thanks

Dr Ajay Mathur
Director General of Bureau of Energy Efficiency.

Dear Sir,

I would like to inform you that 10 days MSP430 workshop is successfully completed at BVB on 29th July 2009. The workshop was attended by 24 students from various Engg. colleges like BVB Hubli, BEC Bagalkot, HREC Nidsoshi, Dayanand sagar Bangalore, GIT Belgaum, Mandya Engg. College, SIT Tumkur. This program was conducted by "Value Addition Training Cell" of BVCET.

The students felt very happy to go through the course. The course covered Architecture of MSP430, Getting used to IAR,eZ430 kit, Basic examples on LED control, Motor control (I/O programming), ADC and Opamp and examples on each.

Thanks for your support and guidance.

Anil V. Nandi
Assistant Professor, ECE department
Coordinator - Value Addition Training Cell (VATC)
B.V.Bhoomaraddi College of Engineering & Technology
Vidyanagar, HUBLI-580 031.
Tel: 91-836-2378252(LL), 09986155835 (M)

Dear Sir,

Thanks for reminding us to wish our teachers on Sep 5. Here is a poem I wrote for one of my teachers.

Subtle , not loud
Brilliant , not proud
Gave me confidence , showed me the way
Got me to study , taught me to play
I'll always treasure your gentle touch

Wish I could gift you the Sun , a star
Because to me ,that's what you are
Perhaps this verse can convey
Something intangible mere words can't say.
A heartfelt "Thank you" for everything.

Aditya Venkataraman, 3rd Year ECE Student, NIT Trichy

The Clash of the Titans

The results of the Phase 1 of Texas Instruments Analog Design Contest, India (2009) are now available! Thirty teams from Ten Indian Universities will compile for the Tom Engibous awards. May the best teams win!

அண்ணா பல்கலைக்கழகம் சென்னை

ANNA UNIVERSITY CHENNAI
PROGRESS THROUGH KNOWLEDGE

Bannari Amman Institute of Technology

Bengal Engineering
and Science University, Shibpur

since 1856......

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
GOA CAMPUS

CMR

भारतीय प्रौद्योगिकी संस्थान दिल्ली
Indian Institute of Technology Delhi

Indian Institute of Technology Madras

JADAVPUR UNIVERSITY

UNIVERSITY WITH
POTENTIAL
FOR EXCELLENCE

National Institute of Technology
Tiruchirappalli

Indian Institute of Technology
Kharagpur

TI India Analog Design Contest 2009

The first phase of the contest has concluded and 10 institutions have been shortlisted. A total of 30 teams in these colleges will compete in Phase 2 of the contest for the final prize. For Phase 1, we received more than 125 proposals from about 37 colleges. A team of 15 judges rated the proposals. The judges were full of praise for the innovative ideas from the Indian colleges. We thank all the colleges that participated in Phase 1. The colleges that were shortlisted are listed in the Table below. Congratulations to the colleges that were selected in Phase 1, and best wishes to all the teams in Phase 2!

Winners of Phase 1 of TI India Analog Design Contest 2009		
Anna University	Medical	Design and Development of a Low Cost Video Bronchoscope
	Medical	Design and Development of Medical Ultrasound System Prototype
	Medical	Position Location and Navigation Aid for the Blind
Bannari Amman Institute of Technology	Medical	Bayesian Imaging Concepts for Smart Fracture Detection in X-ray images
	Medical	Blood Pressure Indicating Cellphone
	Medical	Detection Of Atherosclerosis
Bengal Engineering and Science University	Safety	First Phase Signal Conditioning Unit For Detection Of A Single Gas
	Medical	Signal Conditioning Unit For Field Deployable Micro-impedance Biosensors
	Safety	Signal Conditioning Unit For Smart CTD Sensor in Oceanographic Applications
BITS Goa	Safety	A Secure ATM for the Visually Challenged
	Safety	HOME SECURITY SYSTEMS
	Safety	Security System Design by Object (Suspect Individuals) tracking system using surveillance camera
CMR Institute of Technology	Entertainment	Hand-held Reverberation Meter
	Education	Student Attendance Monitoring System using Voice Analysis and RFID Technology
	Medical	Virtual Vision for Blind
IIT Delhi	Energy	Distributed generation using photovoltaic array
	Energy	Generation of Electricity through Wind Energy Conversion System
	Energy	Microprocessor controlled Electronic Load Control for Micro Hydro Power Plants
IIT Kharagpur	Energy	Remote Home Lighting And Appliance Control System
	Energy	Self-Powered Personal Health Monitoring
	Energy	Solar Photovoltaic Emulator
IIT Madras	Safety	Obstacle detector for use in flooded roads
	Medical	Voice Control for Wheelchair
	Entertainment	Wireless Audio Transmitter Reciever Module
Jadavpur University	Medical	Fetal ECG Signal Extraction using Independent Component Analysis
	Energy	Maximum Power-point tracking of Solar Photovoltaic arrays using Adaptive Perceptive Particle Swarm Optimization
	Medical	Signal Conditioning Unit for MEMS based Pressure Sensor
NIT Trichy	Education	MIMO Testbed
	Energy	Portable mobile phone charger using Pico Wind-Turbine
	Entertainment	Voice Operated Robot

Cybermedia Publication has collaborated with Massachusetts Institute of Technology to bring out an India edition of the "Technology Review" monthly periodical. Priced at Rs 100/- per copy, the magazine is a great bargain. It is a rich source of the latest happenings in technology across the world. In the India edition, several articles that are relevant to India are included. In the July 2009 issue, for example, there is a coverage of the "Solar Rickshaws," which, interestingly, was also covered in UniTI July 2009 issue. There is also an article on the "Language ePOD for Indian Students." The report highlights the use of a handheld electronic device which has been introduced in Indian villages to impact Secondary School education in India. School lessons up to Class 8 are already available in English, Tamil, Telugu, Kannada, and Marathi on the ePOD. In an interview with Mr. Nandan Nilekani, the former Co-chairman of Infosys has felt that India is already supplying new technologies and delivering innovations to the world. He emphasizes the innovative business models that India has popularized, quoting ICICI bank and Bharti as examples, and feels they are disruptive in a fundamental way. The issue also carries an essay on the Electronic Voting Machine, something that India can be proud of, which has made it possible to conduct elections smoothly in a country with a population of 1.2B. There is an article on the Wolfram Alpha computational engine which offers online "knowledge search" and an interesting exploration by Narayan Suresh on "Indian queries" conducted on this search engine. You may also be interested in testing out some of your queries on this interesting search engine!

The efforts of Cybermedia to provide MIT's Technology Review (published since 1999) in India are commendable. With well-researched articles and high-quality production, the magazine is sure to be popular among Indian universities and industries!

CCS v4 Announced!

The latest version of "Code Composer Studio" was unveiled in August 2009 [1]. University students and faculty may download CCS v4 for free and use it for up to 120 days. CCS v4 represents a big step from its predecessor CCS v3.3 and offers many advantages.

Eclipse Software Framework

CCS v4 is based on the "Eclipse" open source software framework, which is used in a number of popular development tools and is fast becoming a standard framework. CCSv4 offers many advanced embedded debug capabilities, making it attractive for embedded software developers.

Since CCS v4 is based on an open source software framework, it allows the user to use third-party plug-ins; for example, you can plug-in your favorite editor such as "gvim" or "emacs" to improve your personal productivity. A default editor from Eclipse is also available, which provides advanced capabilities such as code completion. In a similar way, CCS v4 allows the user to make use of third-party tools for source code analysis, source code control, debugging, Perl development, Java Development, C/C++ development, etc. More about Eclipse plug-ins is available from [3].

One of the nice features of CCS v4 that developers would love is the improved window management supported by Eclipse framework. The tool supports the concept of "perspectives" – e.g. a user can have a C/C++ "development" perspective where he/she edits and compiles the code and a separate "Debug" perspective where the code can be debugged. This reduces the clutter of multiple windows on the screen. A user can switch from one perspective to another and return to a perspective at any point of time.

Advanced Development Environment

CCS v4 offers more advanced project management. For example, the version of the compiler can be part of the project settings. In other words, it becomes possible for a user to associate different compiler versions or BIOS versions with different projects.

CCS v4 supports efficient debugging on TI's multi-core DSP architectures. You can debug the code as it runs on any one of the multiple CPUs by setting breakpoints, examining registers/memory associated with the CPU, etc.
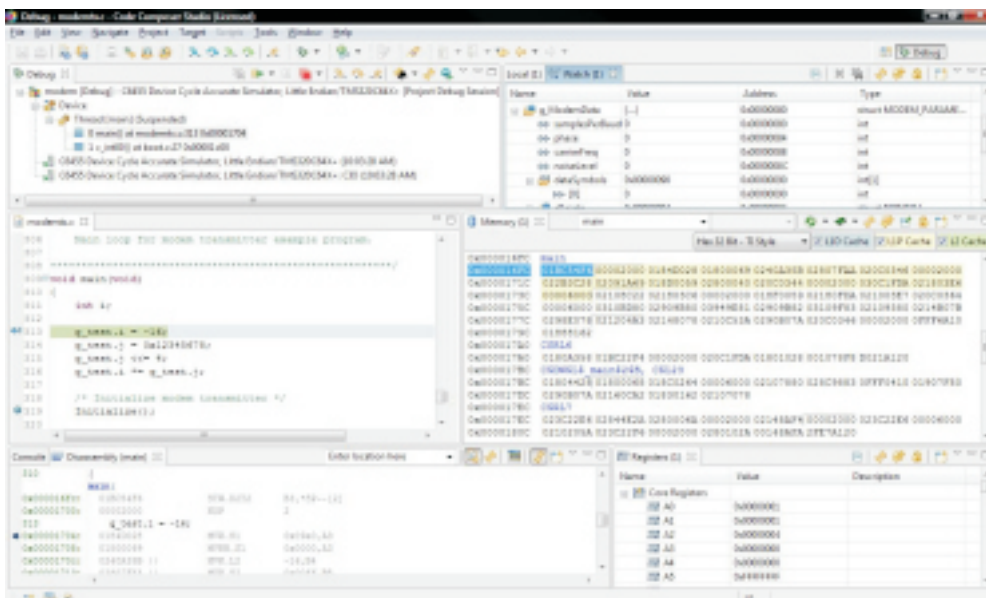
CCS v4 supports an improved scripting environment.

Downloading CCS v4

You will need about 1.5GB hard disk to install the Platinum version of CCS v4, which supports code development for the embedded processor family - ARM, C28x, C54x, C55x, C6000, DaVinci, MSP430 and OMAP. Ideally, CCS v4 needs about 1GB memory during execution. A microcontroller core, which only supports MSP430 and C28x can also be downloaded.

References

▷   A good place to start learning more on CCS v4 is the link – http://tinyurl.com/p7mbq8

▷   An extensive "FAQ" (Frequently Asked Questions) list is available from http://tinyurl.com/krte8y

▷   To learn more about Eclipse plug-ins, please refer to http://eclipseplugincentral.com

▷   To download CCS v4, you must visit http://tinyurl.com/ltkxzb

▷   The CCS v3.3 website can be found at http://tinyurl.com/6mumdl

A screen shot of CCS v4 during a debug session

▷ A "Beagle Clinic for Beagle Community" was held at MS Ramaiah School of Advanced Studies (MSRSAS) in Bangalore on May 30, 2009. This is a regular event intended to address the development-related problems faced by Beagleboard open-source developer community in India. Syed Mohammed Khasim of TI Bangalore coordinated the event. More than 30 participants attended the event. Many thanks are due to Prof. S.Vijay Kumar and Prof. G. Kadambi for their help in making this event possible! A similar event was also held at TI Campus on August 29, 2009 and was facilitated by TI India Technical University. It was attended by more than 35 people.

▷ A "DSP Week" was held in July 2009 as a faculty development program – a detailed report of the DSP Week appears in this issue of UniTI newsletter.

▷ On June 30, 2009, C.P. Ravikumar visited RV College of Engineering, Bangalore, as a keynote speaker in the faculty development program on VLSI Design. He delivered a talk on "Low Power Design." More than 50 faculty members from different parts of Karnataka took part in this summer program. Thanks are due to Prof. B.V. Uma, Prof. S. Jagannathan, and Prof. K. Raja Rao of RVCE for making this visit memorable!

▷ On July 30, 2009, C.P. Ravikumar visited Atria Institute of Technology as a chief guest and keynote speaker in the faculty development program on "Embedded Systems Computing". He delivered a talk on "Evolution of DSP Architectures." In this three-day intensive hands-on program, more than 30 faculty members were exposed to embedded system development. Gurjeet Singh Gill of Gill Instruments facilitated the lectures and hands-on sessions. Many thanks to Prof. Basavaraju of Atria Institute of Technology for making this event possible.

▷ Rajesh Kedia of Texas Instruments, Bangalore, visited MNIT, Jaipur, on August 6, 2009, to deliver two invited lectures – "SoC Design Flow – An Overview" and "VLSI Test and DFT – an Introduction" for the undergraduate students of Electronics and Communication and postgraduate students of VLSI Design. Many thanks to Prof. Vineet Sahula for hosting him during the visit!

▷ Ramakrishna Reddy of TI Bangalore gave a talk on "Introduction to MSP430 : Low power features and applications" and "Demo of Energy Harvesting solution using MSP430" at NIT Warangal on 7th August,2009. About 50 undergraduate/post-graduate students attended his seminar. Many thanks to Prof. Bheema Rao of the Department of Electronics and Communication for hosting the seminar.

▷ C.P. Ravikumar visited Sri Venkateshwara College of Engineering on August 13, 2009 as an invited speaker in the "Baudhayana" series of lectures conducted by the IEEE Student Branch of the college. His talk was on "Modern VLSI Design – Challenges and Opportunities" and was attended by more than 100 students and faculty from the college. Many thanks to Prof. S. Reddy, Principal, and Prof. Siva Reddy, Head of the Department of Electronics and Communication, for making this visit memorable.

Rajesh Kedia of TI Bangalore giving a talk at MNIT, Jaipur – August 6, 2009.

Inauguration of a Faculty Development program at REVA Institute of Technology on Digital Signal Processing Architectures – August 13, 2009. Prof. S.S. Manvi, Head of the Department of Electronics and Communication, Prof. R.P. Reddy, Principal, Dr. C.P. Ravikumar, TI Bangalore, and Mr H.S. Aravind, Faculty Member in Electronics & Communication.

▷ Ramakrishna Reddy of TI Bangalore gave an invited talk on "Embedded Microcontroller : MSP430 Development of Embedded Application and OS Issues" at the conference "Embedded OS and Microcontrollers" held at MS Ramaiah School of Advanced Studies on 28th August,2009. About 80 professionals attended his talk. Many thanks to Prof. G. Kadambi and Prof.Shilpa Chadhari for hosting his talk.

A report on DSP Week

In collaboration with IEEE Bangalore Section, IEEE Signal Processing Society (Bangalore), and IEEE Circuits and Systems Society (Bangalore), UniTI held an exciting DSP event during June 30 – July 4, 2009. This goal of this five-day program was to provide an exposure to TI DSP to faculty members from Indian Engineering colleges. The program was attended by more than 30 faculty members and research scholars. Since some of TI customer companies were also present, the DSP Week also provided a forum for industry-academia interaction.

The program began with a day-long hands-on introduction to TI DSP programming on the "Code Composer Studio," which was facilitated by E. Manivannan of Texas Instruments. This was followed by a two-day workshop on "Software Optimization on TI Digital Signal Processors" conducted by Venugopala Madumbu and Kapil Ahuja of Texas Instruments. The workshop exposed the participants to code optimization techniques on TI DSP architectures, focusing mainly on C64x architectures. A "Tech Day" on Embedded Processing was held to expose the participants to the new developments in DSP technology. John Dixon, Praveen Ganapathy and several application engineers and TI customers spoke at the "Tech Day" and shared their expertise and experiences. The DSP Week concluded with a day-long event on "Open Source Development of Embedded Systems" facilitated by Syed Khasim of Texas Instruments and Jayaramudu of Cranes Software.

Attendees from academic institutions received participation certificates from UniTI. Their feedback has been very enthusiastic. "I liked the session on compiler optimization for C64xx, architectures. I think some more programs optimization of the code would be further informative," said Prof. M. Reddy of Vellore Institute of Technology, who was a participant. Prof. Rajeswari of Thiagarajar College of Engineering expressed happiness over the interactive nature of the sessions. Prof. Rusnik Mangag of MGM College of Engineering felt that the queries were answered satisfactorily, but the training could be longer.

Many thanks to Praveen Ganapathy, Prabindh Sundareson, and K. Aravindhan for their help in steering the event. Our thanks to the speakers for their contribution. We thank the office bearers of the IEEE Bangalore Section for their support. Our thanks are due to Ashfaq Ibrahim of Cranes Software for his help. Finally, many thanks to P. Mahesh for the local arrangements.

A similar activity is being planned in Chennai. The details will be published on UniTI mailing list.

Audience at the "DSP Week 2009"

John Dixon interacting with participants of DSP Week 2009

Product Demonstration by L&T from a TI Customer at DSP Week 2009

Thermoelectrics - Hot Technology!

Thermoelectric effect, which you may have learnt in high school, may be the solution for low-power RF communication. Mircopelt has built thermogenerators that are capable of generating several milliwatts, depending on the difference in temperature of the two metal surfaces. They make use of MSP430 microcontroller and low power RF components from Texas Instruments for wireless communication. Their products make use of Zigbee low power RF communication protocol. A video of the product may be viewed at http://e2e.ti.com/media/p/36883.aspx, where a thermogenerator is demonstrated. During the demo, a lighter is used to heat the metallic surface, increasing the temperature of the surface; a status LED blinks to indicate that sufficient voltage has been generated for enabling wireless communication.

Teaching is not a lost art, but the regard for it is a lost tradition.

Jacques Barzun, French Historian

**Dear Teacher,
Please accept our appreciation and best wishes on the occasion of Teacher's Day (Sep 5, 2009).**

- UniTI

Forging Relations between Indian Universities and Texas Instruments, India

Beagle Bored? Play a Game!

If you visit http://beaglegame.com/ you can play the "Beagle Game," where the objective is to use the Beagle dog to locate in the shortest time a Beagle Board hidden in the lawn. My own game-playing skills are limited and it took me a little over 2 minutes to "win." (There are players who have won in less than a second.) I picked up a lot of other goodies such as links to useful websites. You and your students may find this game useful!

Free Software for Courses!

Do you teach a course on Analog Design or Instrumentation? The following freely downloadable software from Texas Instruments may be of interest to you!

ADCPro™

ADCPro allows you to easily test and measure the quality of an Analog-to-Digital converter. With ADCPro, you do not need expensive logic analyzers or complex analysis routines. The software can be downloaded free from the website below.
It can be used in two modes. In the stand-alone mode, it is useful in analyzing data sets captured during ADC testing. It can also be used with a Texas Instruments ADC evaluation module (EVM) and suitable data capture card, to create a powerful evaluation package.

TINA-TI™

Tina-TI is a free, easy-to-use, powerful analog simulation program based on a SPICE engine. TINA-TI is a fully functional version of TINA, loaded with a library of TI macro-models plus passive and active models. You can download TINA-TI from the website mentioned below. TINA-TI has no limit to circuit size and a number of example circuits are included in the installation. TINA-TI also supports the simulation of switch-mode power supplies.

http://focus.ti.com/docs/toolsw/folders/print/tina-ti.html

FilterPRO™

FilterPro™ is a free software useful for designing filters on the Windows platform. It is useful designing Multiple Feedback (MFB) and Sallen-Key low-pass and high-pass filters using Voltage Feedback Op Amps, resistors and capacitors. It also supports a fully-differential version of the MFB circuit. This program includes Bessell, Butterworth, Chebychev, and linear phase filter types and can be used to design filters with 1 to 10 poles. The capacitor values in each stage can be selected either by the computer or entered by the designer. An "always on" prompt window provides context-sensitive help information to the user. The response of the filter is displayed on a graph, showing the gain, phase and group delay over frequency

http://focus.ti.com/docs/toolsw/folders/print/filterpro.html
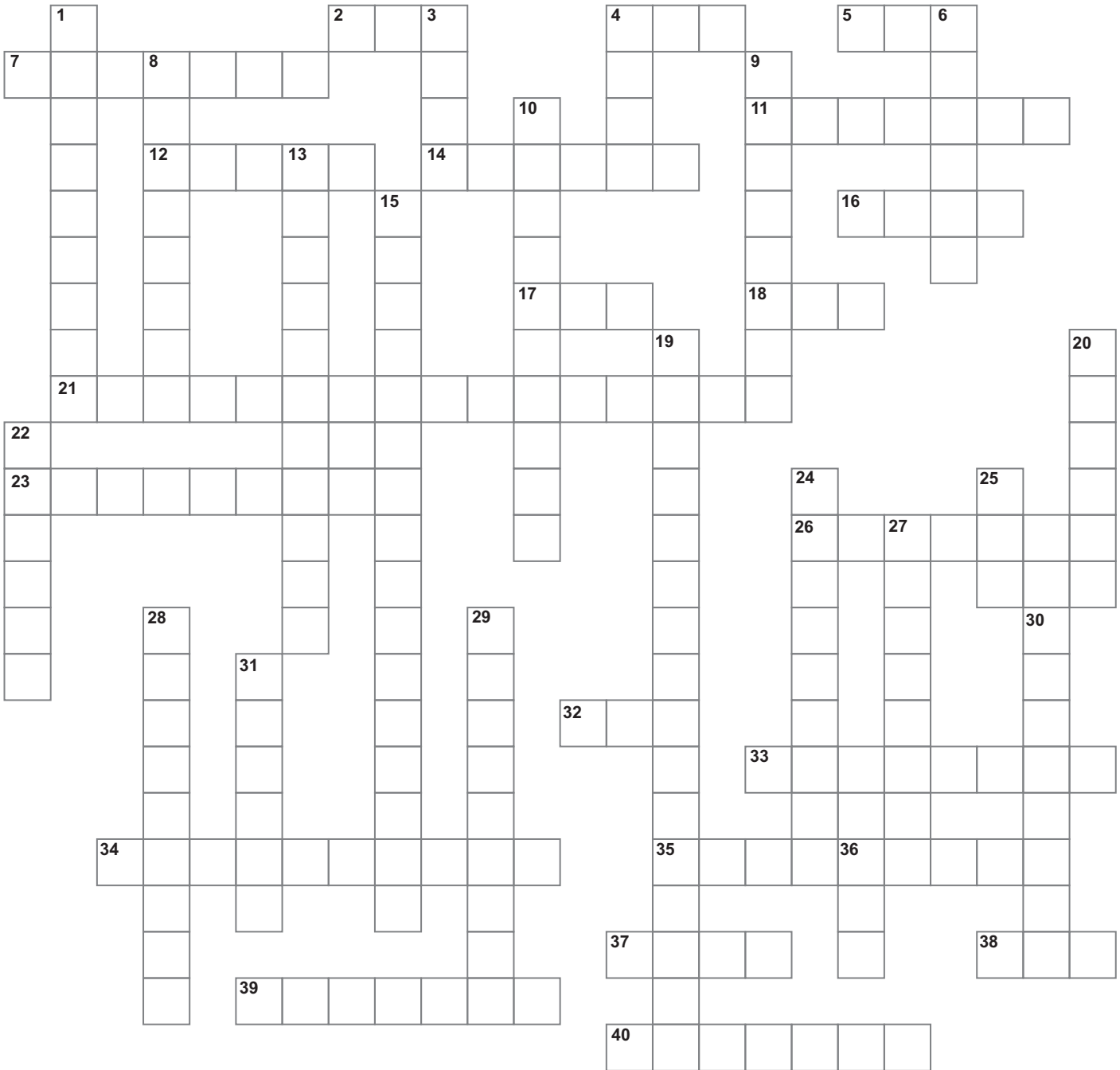
ACROSS

2 The TMS470 microcontroller includes this controller for automotive applications (3)

4 This e-cryptogram can identify every merchandise (3)

5 Cruncher of real numbers (3)

7 The root of a number is so fundamental? (7)

11 In Odd Rain we find a software stack for mobile devices! (7)

12 This memory is not just a spark in a pan – you see so much of it integrated in the TI microcontroller (5)

14 The element that may follow silicon? (6)

16 Its more formal name is "Transponder" (4)

17 How the New York Stock Exchange may refer to TI (3)

18 This synchronous DRAM will provide you data at twice the speed (3)

21 What you need to capture Mr Joule and store him (6,10)

23 A nicer fet can be used to make a crossing point (9)

26 The dominating power in the land of 65 nm and beyond? (7)

32 If you are a UNIX buff, you would think this tool converts me to C (3)

33 Because of its ultra low-power feature, MSP430 makes an excellent case for the spoilt version of a bear plot (8)

34 For real issues, after you make your point, you are allowed only so many places (5,5)

35 A disturbance coming from the turret pin? (9)

37 The architecture of MSP430 can be described like this? (4)

38 A medical imaging technology (3)

39 A Mangled Burst Op is a way to connect the eZ430 MSP430 kit to your PC? (3,4)

40 Bin Yams may be transformed into this real-time OS (7)

DOWN

1 Hide your information in this secret on-chip reserve (4,5)

3 If you travel to North East of South Carolina, you will find a programming language for deeply networked systems! (4)

4 Reflection acoustic signal (4)

6 This idealistic bus for interfacing physical layer to ATM layer was invented by Thomas More?

8 Bandwidth of an ideal OPAMP (8)

9 The safety-keeping in a microcontroller (8)

10 If artificial intelligence was an extension to human brain, it is now the turn for artifical extension of body parts? (10)

13 The secret hiding place for the canine cartoon character from Peanuts can solve data coherency problem (6,5)

15 This circuit can bring down your potential, but will sure cut down your electricity bills! TPS780 is an example … (7,9)

19 Footsteps lead to generation of current! (5,11)

20 The modern way to gauge the consumption of energy or the rate of flow of fluids (1,5)

22 This embedded real-time operating system is so small, it can fit "IN TOYS" (4,2)

24 The ZZZ approach to low power (5,4)

25 Knock gently to get access to the test infrastructure in your chip! (3)

27 A curt Tao master can mimic that actions of muscles (8)

28 The Nobel man from Texas Instruments (4,5)

29 Detects a signal from the nervous system (3,6)

30 The device can double up for me, AI, or Tu! (9)

31 Useful for cleaning up a signal (6)

36 Look closely into the CRT and you will find time ticking away (3)

C5505 eZdsp USB Stick
DSP Development Made Easy
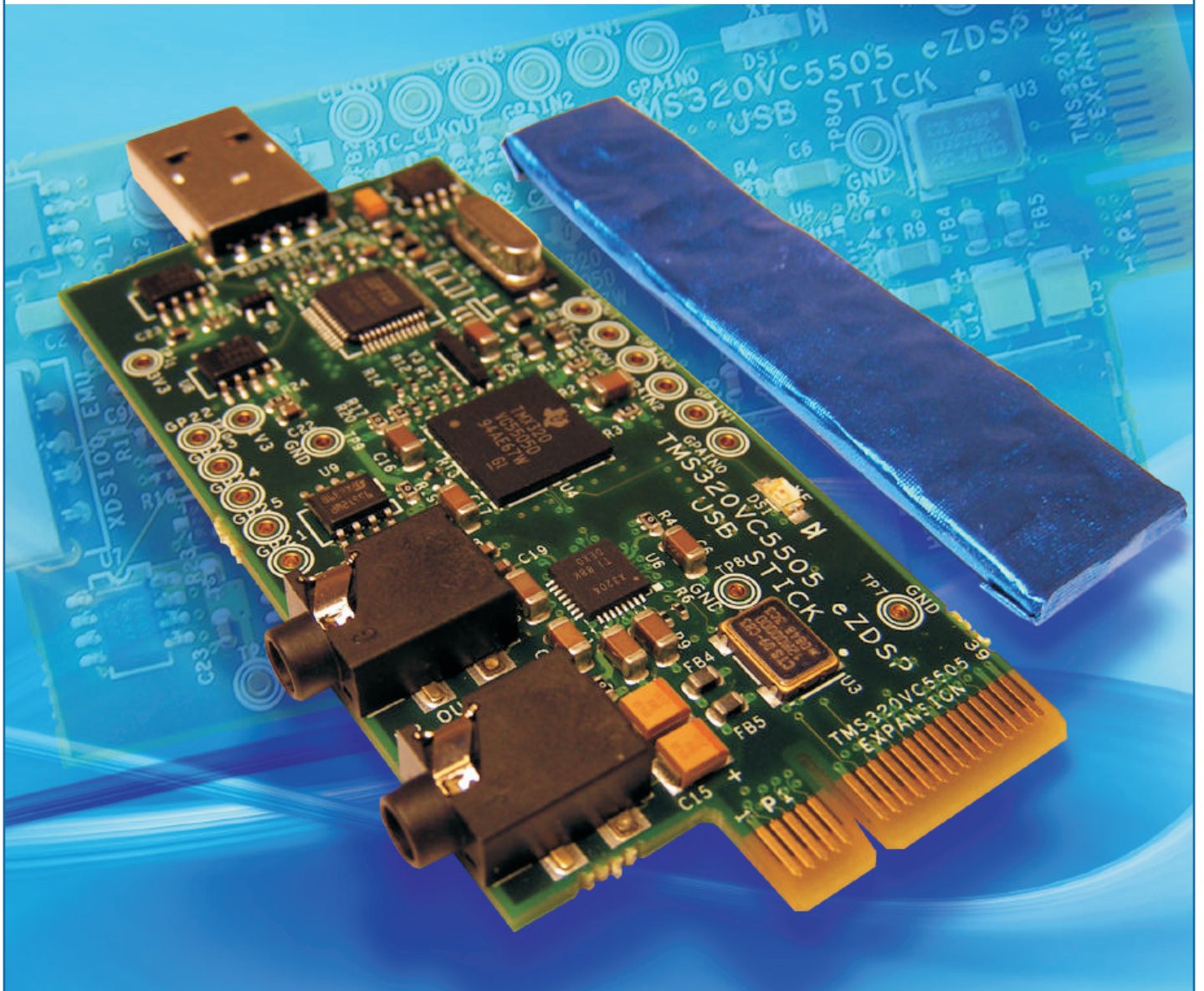
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On-Line Community	**No Cables**	**USB Bus Powered**

Begin development today with eZDSP Tool