APPTRONICS review

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Annual Issue

From the HoD's desk

Academic Bulimia

Academic bulimia as the name implies is an 'intake disorder' in academic matters. Reading without thinking and reproducing it without understanding is characteristics of this disorder. This happens to be manifest among persons of all walks of life in doing their tasks. It is of great concern when the student community is habituated to this syndrome.

Why is this happening? It is mainly due to poor time management, difficulty in concentrating and negative attitude towards that task. Every time you put off something you dislike, you strengthen the habit of not doing it. You may be uncertain about your priorities, goals and objectives. If you observe the work habits of people who have achieved outstanding success they invariably show a well designed pattern of schedule.

How can we outgrow this? First of all identify the goals, strengths and weaknesses. Start organizing your books, materials, study table and room. Fix your schedule; calculate your hours of study, coaching and relaxation time. Devise a study / work time table. Always set realistic goals and discipline to use time wisely. Goals should be specific and measurable as possible. Frequently revise and update your goals. As a growing person, your needs will change over a period of time.

A new year is a good time to dig out all things undone and begin to tackle them right now. I wish you all an organised, structured and effective 2009.

AT YOUR DOOR STEP!

It is another new year! It is time to look back and check for the errors, mistakes, the pitfalls and the wrong doings. It is time to see what can be done not to repeat those.

Let your efforts turn successful.

Introducing science journals

Journal of Geophysical Research (JGR)

Journal of the American Geophysical Union(AGU).
Founded in 1896 by the AGU's then president Louis A. Bauer.
Publishes original scientific research on physical, chemical, and biological processes.
Contributes to the understanding of the Earth, Sun and solar system, and all of their environments and components.

History

Was entitled Terrestrial Magnetism at its founding.
Was entitled Terrestrial Magnetism and Atmospheric Electricity from 1899-1948.
In 1980, JGR was split into 3 sections- JGR—Space Physics, JGR—Solid Earth, and JGR—Oceans. Four more sections were added subsequently- JGR—Atmospheres in 1984, JGR—Planets in 1991, JGR—Earth Surface in 2003, and JGR—Biogeosciences in 2005.

Scope of each section

JGR—Oceans covers physical, biological, and chemical oceanography.
JGR—Solid Earth focuses on the physics and chemistry of the solid Earth and the liquid core of the Earth, geomagnetism, paleomagnetism, , seismology, geodesy, gravity, and tectonophysics.
JGR—Space Physics covers aeronomy and magnetospheric physics, cosmic rays, and heliospheric physics.
JGR—Planets covers the geology, geophysics, geochemistry, satellites, asteroids, rings, comets, and meteorites; planetary origins; and planetary detection.

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Observations/Comments

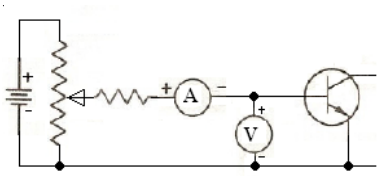
... A column by PRM.

I have always been of the view that laboratory work and project work have a major role in undergraduate engineering courses. Not that theory papers do not have any role. Definitely, theory papers, like the one on reliability, can also help to induce engineering way of thinking and behaviour in students. Of course, it all depends on how the course is delivered. Importance of method of handling the course has much more significance in the case of laboratory work and project activities. In this issue I would like to invite your attention to a specific observation on the way in which we have been handling one experiment.

It is about an experiment for S3 as part of Circuits Lab. Objective of the experiment is determining the CE characteristics of a BJT.

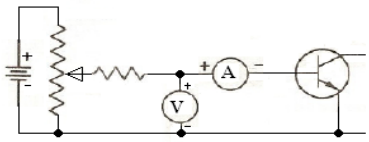
I found all students giving the transistor type number as BC 547instead of BC547B. I went through records of senior students also. This has been the case always. There are three varieties of BC547: BC547A, BC547B, BC547C. Limiting values of collector current, collector-base voltage, collector-emitter voltage, etc. are the same for all BC547. As you know it is a proelectron numbering scheme where the first letter stands for the material (A for germanium, B for silicon, C for gallium arsenide, and D for other compound material), and the second letter specifies the type of device (A for low power diode, B for varactor, C for audio frequency low power transistor, etc.). The last letter A, B or C (There are some other types with the last letter from A to E.) shows the range of beta values. Values of beta for BC547B range from 200 to 450, and the typical value is given to be 290. This differentiation of beta range is not being noted at all, and the students are found to use typical value of beta as 100. You may guess the consequence!

While doing the same experiment I made another observation, a much more serious one. See the circuit given below. This is the part of the circuit on the input side normally



Ammeter A measures the base current, and voltmeter V measures the base-emitter voltage. Relation between the base current and the base-emitter voltage is the input characteristics. [Circuit part for the output characteristics is not shown.] For a beta value of 250, fixing collector current not to exceed 50 mA [keeping it sufficiently less than the specified maximum of 100mA] we go for a maximum base current of 200 µA.

For base currents up to 200 µA, what could be the maximum drop across base-emitter? Remember, it is a low current device. You must agree that it cannot be more than about 0.75 V; it cannot have values like 1V or 1.2V. But you verify our students records[neatly certified!]. You can see values recorded upto 1.5V or more. Can you guess what has gone wrong? Is it that every student is simply cooking up the values? No, it cannot be so. Cooked values are generally more accurate than experimentally observed values. To see what has really happened, you may first verify the circuit part itself. In actual experiment, a small change is made in the positioning of voltmeter, as shown below.



The difference is that the voltmeter now measures not the voltage across the base-emitter junction, but the sum of the base-emitter voltage and the drop across the ammeter. In practice there is a drop across the ammeter. We must make sure that this drop is much less than the one responsible for the current. The drop partly decides the accuracy. The reason for such a change was quite interesting. Ammeter and volt meter were connected first as shown in the earlier diagram. But then, the microammeter had to be replaced by a milliammeter! Base current was so high!! So what is the solution? Try other combinations of connections, and get satisfied when the current is in microampere range! [Is it not very much analogous to that old sarcastic case of searching for the lost article under a street light when it was actually lost somewhere else where there is no light!] And, what about the voltmeter reading? That seemed to be of no concern as we are using a voltmeter of sufficient range!

The real problem here is that the voltmeter is drawing large current, and initially when the circuit was wired as it should be, the ammeter was reading the sum of the base-emitter current and the current drawn by the voltmeter. It so happened that the voltmeter current was in mA! In the revised circuit the voltmeter current is not being monitored, and so it goes unnoticed. But another fault crept in about which nobody was bothered, neither the ones in charge nor even our bright students. Of course, we find pleasure in making it a habit to practice things entirely different from what we preach. We are not accustomed to inquire about or challenge things which we observe to be totally different from what we have learned. We are not ashamed to draw, certify, characteristics with diode drops of more than one volt at low currents.

It is high time that we change our attitude.

Advanced Audio Coding

We have already discussed MP3 and MPEG2 video coding standards. We have also seen that, at least theoretically, AAC (Advanced Audio Coding) provides 50% better compression than MP3. In practice, AAC gives, on an average, the same quality as MP3 at about 70 % of the bit-rate. Let us get into details of AAC coding and understand how it provides better compression.

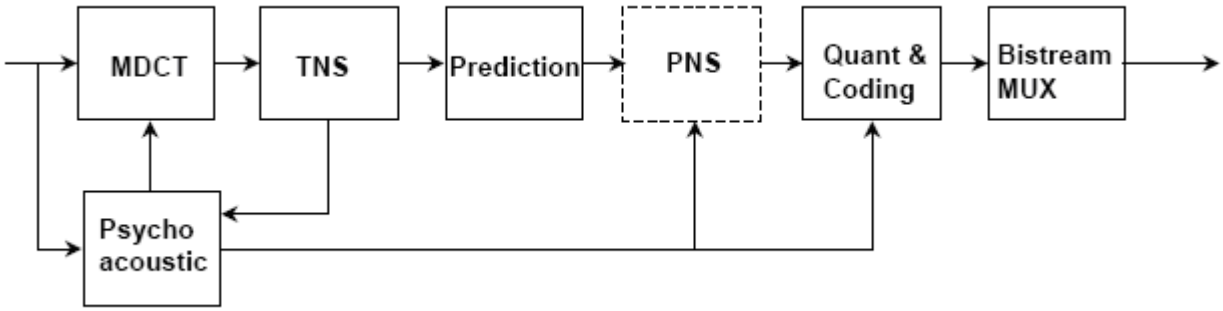
AAC coding technique is a generic standard for coding stereo and multichannel audio signals. It is specified as part 7 of MPEG2 standard, and as part 3 of MPEG4 standard. MPEG4-AAC is more common, due to its quality, compared to MPEG2 AAC. Advantages offered by AAC over MP3 include support for more channels, higher sampling frequencies (8-96kHz), arbitrary bit rate (1-48 kbps), variable frame length (1024 or 128 samples), simpler filter bank (MDCT with higher frequency resolution of 1024 filters instead of hybrid filter bank), more flexible and improved joint stereo coding, TNS (temporal noise shaping), backward prediction and PNS (perceptual noise substitution). As in MP3, it does non-uniform quantization and Huffman coding.

There are 4 AAC profiles.[Profiles are sets of tools supported by encoder and decoder.] Low complexity (LC) profile is the simplest and is most widely used. Main profile (MAIN) uses backward prediction. MPEG4 AAC has SRS (sampling rate scalable), LTP (long term prediction) and PNS (perceptual noise substitution). PNS improves coding quality of signals, such as speech, with significant amount of noise. But, noise like signals result in flat spectrum and coding gain is limited. It also results in inefficient generation of noise at the decoder side using transmitted spectral lines. Efficient generation of noise is required for good quality decoding.

AAC with SBR (spectral band replication) is known as HE-AAC or aacPlus v1 and if PS (parametric stereo) technology is also included, it becomes HE-AAC v2 (high efficiency AAC v2) or aacPlus v2.

Modified discrete cosine transform is calculated as

$$X_{MDCT}(k) = 5\, x(n)\cos[2Ï/N.(k+1/2)(n+1/2+N/4)] \quad \text{(N-1)}$$



The encoder first converts signal in time domain to frequency domain using MDCT (modified discrete cosine transform). The transform coefficients are quantized based on psycho acoustic model and encoded. For error resilience, internal error correction codes, such as RVLC (reversible variable length codes), are used. AAC allows block lengths of 128 and 1024 based on signal characteristics. If a transient occurs, shorter block length is chosen for better temporal resolution. Longer block length gives better frequency resolution and is the default block length for better coding efficiency.

Perceptual coders with high frequency resolution usually exhibit time varying error at certain frequencies. Signal could sound distorted due to time variant nature of error and noise at specific frequencies.

MPEG4 AAC with MPEG4 video is used commonly in multimedia applications. The popularity of MPEG4 video is due to its rich error resilience feature set and computationally efficient algorithms compared to MPEG4 part 10 or H.264 coding. But H264 can give better (theoretically 50%) video compression compared to MPEG4.

Note - Based on spectral resolution of time or frequency mapping, audio coders differ. Coders may be filter bank coder, transform coder or hybrid coder. Filter banks are used for low frequency resolution and transform coding for higher resolution. Uniform or non uniform quantization technique may be used. Coding scheme may be companding or Huffman coding.

Meena

SmartQuill

You get an idea while on the road. You note it on your palm

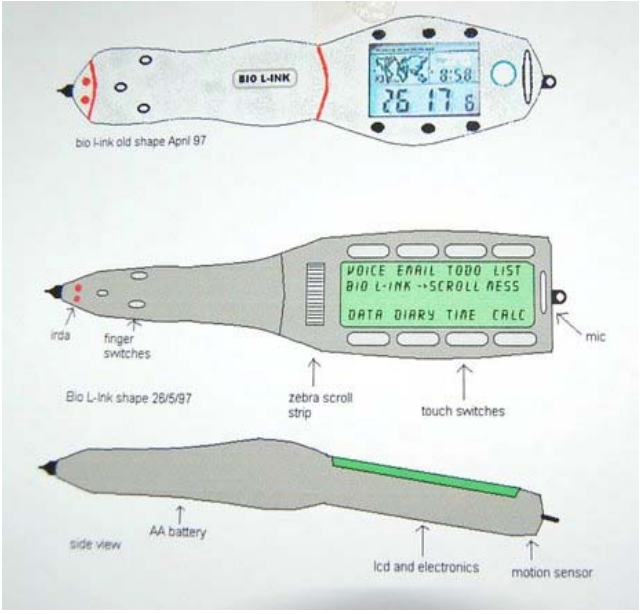
(Provided you have a pen with you.)! Forget about such old and obsolete practices. Buy smartQuill, write in air, and have it recorded!

"Make devices as small as possible" is present trend. Computers are getting smaller than handheld. But then, there is an associated issue. Keyboards become so tiny that one requires needle-like fingers to operate them. Screens need constant cursor controls to read even a simple text. The introduction of SmartQuill has solved some of these problems.

SmartQuill was invented by Lyndsay Williams in 1997. It is a pen slightly larger than ordinary fountain pen, with a screen on the barrel. The sleek and stylish pen is different from other electronic pens in the market today. It contains an ink cartridge so that users can see what they write down on paper. It remembers the words written using it. The SmartQuill contains sensors that record movement by using the Earth's gravity. User can enter information by pushing a button. Users do not have to write on any special pad in order to record what they write. Information can be entered using one's own handwriting. Any platform, like paper, screen, tablet or even air can be used for writing. The pen records the information inserted by the user. There is also a small three-line screen to read the information stored in the pen. Users can scroll down the screen by tilting the pen. The pen is then plugged in to an electronic docking station, text data are transmitted to a desktop computer, printer, modem or to a mobile telephone to send files electronically.

Lyndsay Williams is managing director of Girton Labs Ltd in Cambridge, UK, responsible for design of new imaging devices and computers to aid Alzheimers. She was previously with Microsoft.

It is an interesting idea, and it even comes with a security attribute. SmartQuill can be trained to recognize only the owner's handwriting. If someone else picks your SmartQuill and tries to write with it, it will refuse to record the information. It has a computer housed within the pen which permits all features of a normal personal organizer.



Technology used in SmartQuill for display is Kopin Corp's cyber display technology. Cyber display is a ¼ inch diagonal LCD that uses circuitry built on a silicon wafer, then removed and mounted on glass. The displays are integrated to miniature monitors using their own backlighting, optics, ICS and packaging. Pen has accelerometers to measure hand movement in 2 or 3 planes and an on board DSP to convert hand movements to ASCII characters for pen applications. It does single character recognition and records cursive letters which can be downloaded to PC for decoding. SmartQuill works by measuring the pen's movements and matching them to the movements that produce letters and words programmed into its memory. Consistency of handwriting, rather than neatness, is the only condition for accuracy.

The pen can align text irrespective of whether it is held in left hand or right hand. This is made possible by using Micro electromechanical systems (MEMS) tilt sensors to measure tilt angle with respect to earth's gravity. The SmartQuill microcontroller reads the angle and then maps the large screen display onto the small four line display. SmartQuill can also scroll through pages of display, by tilting it in the hand Of course a number of limitations are yet to be overcome. Only a proto has been developed and tested. The choice of words is limited presently to what characters the LCD display driver can show while upside down – only 14 of the 26 letters of the alphabet are usable in the proto. These 14 characters were processed by anagram software to produce 900 words that used these characters. The proto SmartQuill has 4MB EEPROM memory. At a time, up to 10 pages of notes can be stored on this. The data is stored in the memory on the pen until it is uploaded to the personal computer.

Rahul Mohan S7 AEI

Undergraduate Engineering Project:

HOW? and WHY?

A few days back I got an interesting mail from an X-colleague of mine. Like me, he also worked in a leading research organisation for quite a long period, and then took up teaching. Now he is a professor in a reputed engineering college. I said that his mail was interesting. It was about plagiarism. To him every one of his senior students is a plagiary.

He says that he has not even one student who does any original work for the project. Every one steals off something from somewhere. My friend was expressing his helplessness. I think that I have helped him come out of his real problem. My long reply should have achieved that.

The issue is not one of his concern alone. I have heard many a discussion on the same topic. There are eminent teachers who are committed to the cause of good education who argue that all projects taken up as part of the course work in undergraduate level must be original, that sufficient literature 'search' must be done to ensure that nobody else has ever done such a work any time earlier.

I do not agree with these views.

Our university syllabus prescribes project work in two semesters: the sixth and the eighth.

No period is allotted during the fifth or seventh semester, though some of us insist that project work be started by the beginning of the fifth semester itself. We have tried to extend the project activities to the fifth and seventh semesters in vein.

In the sixth semester the students get hardly 40 class hours to do the so called mini project. You may insist that another 60 hours are spent outside of class. What original work do you expect them to do in a total of 100 hours? What do you expect them to gain from such an 'original' work? Where are you going to place them? What do the industries which are going to offer them jobs demand from them? Let us be realistic.

We are concerned with engineering education. We are concerned with imparting knowledge, skill and attitude in the students which could help them to become efficient professionals, professional engineers. It must be possible to define the objectives of the undergraduate engineering projects with this broad objective. We may define the objectives as follows.

Our students, when they join an industry or research organisation, must be able to take up any assignment given to them with confidence, and work systematically to achieve the target in scheduled time. Project work in undergraduate level must be defined to meet this objective. Various steps involved in doing a project with such an objective are given in box.

In addition to meeting the above said objectives we may aim at making the students learn some new topics like a new statistics, a programming language and a hardware or software tool, which we think could be of help to them in future.

Main Steps in a Project Work

1. Identifying a task which can be defined as a project. It must be simple enough to be realised in the given time. It must be sufficient enough for the team to be engaged through out he allotted time.
2. Understanding the essence of the task. Noting down/identifying the requirement in proper technical terms.
3. Generating the requirement specifications which will form the input specifications for the design and development.
4. Evolving a conceptual approach. There could be more than one conceptual approach.
5. Evolving the respective conceptual designs. Working out the relative merits and demerits of these options, and selecting one to proceed. Preparing a conceptual design report.
6. Preparing for review of the conceptual design.
7. Presenting for review.
8. Making improvements/modifications to the conceptual design incorporating the review outcomes.
9. Dividing the total work into a number of modules so that the work can be divided among the group members.
10. Preparing realisable schedule for the total project.
11. Preparing detailed design report, presenting it for review.
12. Doing the FMECA (failure mode evaluation and criticality analysis), incorporating measures to prevent/minimise the identified failure modes.
13. Identifying components and procuring them.
14. Testing the bought out items before they are put to use.
15. Developing the project deliverables, both H/W and S/W.
16. Doing T&E of each subsystem being developed.
17. Integrating the subsystems into the total system.
18. Doing T&E on the total system.
19. Packaging the system.
20. Documenting each stage of activity in a properly maintained work diary, preparing necessary documents for specific stages of activities like T&E,

May be, I have missed out a few points. It doesn't matter. It is all about doing a project with all its minute details. It is all about getting trained in such activities. It is all about learning how to do an engineering task. It is all about learning project management.

Do you see any stage where plagiarism is a serious issue? Yes, it is an issue if one identifies an already existing work for his project without acknowledging that. Whenever an idea, an existing concept , or anything of that sort, is taken from somewhere or from somebody it must be recorded in the work diary, and brought properly into the final report.

A few function generators are available in our lab. But you might have felt that it would be better to have one or two more. You can go through the specifications of the available ones, and define somewhat better specifications for your work. No matter whether such an equipment exists or not. Do not worry about plagiarism. It does not turn out to be real issues when the objectives and scope are clearly identified (For sure it is not claimed to be an original work.).

Understand that the project work is a part of training to mould the students as engineers. It should be seen with all seriousness.

Guides may always remain alert to identify some original work which could be assigned to a student team as a project work. Of course, nobody need ban any original work; in fact such work must be encouraged.

Having said all these, let us try our best to take up at least a few good original developmental work as part of the undergraduate project. But let us not argue that we will not permit students to do something which is already there.

Before I conclude, let me remind you that to meet the said objectives, it is essential that students are made to work on their own. It is essential that they are monitored and guided properly. It is to be appreciated that guides have a very important role to play in imparting proper training to the students through project work.

Setting an example is not the main means of influencing another, it is the only means.

- Albert Einstein

Failure is simply the oppurtunity to begin again, this time more intelligently.

- Henry Ford

HART Protocol

The HART (Highway Addressable Remote Transducer) was developed by Rosemount Inc. as a proprietary digital communication protocol for their smart field instruments. In 1986, it was made an open protocol. The HART protocol provides backward compatible solution for smart instrument communication as both 4- 20 mA analogue and digital communication signals are transmitted simultaneously on the same cable. This feature made it the most widely used standard in modern instruments. HART products available now include analogue and digital process transmitters, process receivers (valves), local (field) controllers, calibrators, etc.

Overview:HART is intended to allow easy calibration, range setting, damping adjustment, error control, etc. in microprocessor based systems. It uses FSK modulation to transmit digital signals between the devices. Logical 1's are represented by a frequency of 1.2 kHz and 0's by a frequency of 2.2 kHz. These signals are then superimposed on to the 4-20mA control signals of the device. This feature helps in adjusting the operating point of the instrument without affecting its working (on-line calibration) and reduces operation related risk.

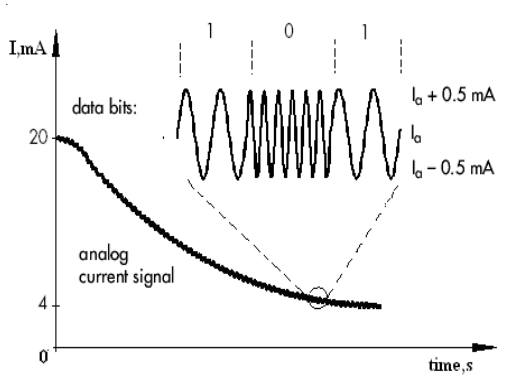


Fig: FSK signals on 4-20mA analogue control signals

The HART communication signals have a frequency range well above the device control signal (about 10 Hz). So simple filters can be used to separate control signals and HART signals. In peer to peer mode only one device is attached to a device loop and both analogue and digital signals are used for communication, while in multi drop mode up to 15 devices are connected to a device loop keeping the analogue signal at 4mA.

HART protocol follows a master-slave configuration and allows up to 2 masters (controlling devices like DCS, PLC's, handheld HART calibrators, etc.) and many slave devices like temperature and pressure transmitters.

Anu George S7 AEI

Read This Paper

presented by : K Motoi, et.al.

in : *Conference of the IEEE EMBS, August 2007*

It's about **Bio Instrumentation**

For several decades considerable amount of research activity has been directed towards advances and developments of biomedical instrumentation. These researches lead to new concepts for measurements such as breath monitoring by thermal film, heart beat monitoring by electro mechanical film, bio impedance measurement using spot electrode array, and electrophysiological measurement using dry electrodes.

Currently available breath monitoring system operates by inserting a thermistor into patient's nostril. A new method that is less intrusive and more useful is being introduced based on a versicolour thermal film in conjunction with image processing techniques. Ex-inhalation is displayed as 2D colour pattern on the film placed under the nose.

Conventional method of heart beat monitoring is by using microphones as in phonocardiogram (PCG). By using electro mechanical film type transducer, composed of thin, elastic, three layered polypropylene films, PCG can be recorded more easily. Like an ECG electrode this film transducer can be directly attached to the chest to detect vibrations from heart.

Applications of bio impedance measurement include evaluation of cardiac output, stroke volume as well as cardiac function. In earlier days, for clinical purpose, we made use of tetra polar band electrode system. This method could not be used for continuous monitoring purpose. Thus we go for another method called spot –electrode array. The impedance changes measured with this electrode array showed a good correlation with those using 3D finite element methods (FEM).

Electro physiological signals such as ECG, EEG and EMG are monitored by attaching electrodes to the skin through gel which may cause skin reddening and irritation. Why not monitor it with high stability, high signal to noise ratio and without any skin irritation using capacitive type electrodes, flexible dry surface electrode or carbon nano tube array based dry electrode? All these dry electrodes are under development.

Monitoring of health at home is very important. Researches in the field of biomedical instrumentation have lead to the development of a system called fully automated network system for long term health care monitoring. This system provides continuous monitoring of a bedridden patient without needles or sensor attachments, let the patient be in bath tub or bed!

The system is really interesting. The author discusses threadbare the proposal with attractive figures and illustrations.

Jasna K.A

Biometrics and Fingerscan

With the increased use of computers as vehicles of information technology, it has become necessary to restrict access to sensitive data. Biometric security and authentication is the most preferred one for this; traditional methods involving passwords and PIN numbers are not so reliable. Biometric methods require the person to be identified to be physically present at the point-of-identification but eliminate the need to remember a password or carry a token. By replacing PINs, biometric techniques can potentially prevent unauthorized access to or fraudulent use of ATMs, cellular phones, smart cards, desktop PCs, workstations, and computer networks. An important issue in designing a practical system is to decide how an individual is to be identified. Depending on the context, a biometric system can be either a verification system or an identification system. This article briefs about finger scan method with emphasis on the scanners used in this technology. Bio' signifies life or living organisms; 'metrics' signifies measurement. Biometrics refers to the automatic identification of a person based on measurement of his physiological or behavioural characteristics such as finger, retina, iris, voice and signature. A biometric system is essentially a pattern recognition system, which makes a personal identification by determining the authenticity of a specific physiological, or behavioural characteristics possessed by the user. Finger print recognition, a popular biometric identification method, is available in present day laptops.

Finger prints are unique to each individual and two fingerprints are not alike. Local ridge characteristics, occurring at either the ridge bifurcation or a ridge ending form minutiae. Finger scan is a biometrics product which provides some unique characteristic or physical property of the fingerprint of the individual. It helps to verify the identity of a person unambiguously. The imaging process is based on digital holography, using an electro-optical scanner about the size of a thumb print. The scanner reads three-dimensional data from the finger such as skin undulations, to create a unique pattern that is composed into a template file and recorded in the finger scan database. It stores characteristics of the finger, and not the fingerprint itself. The fingerprint cannot in any way be created from the template. A template can only be compared with a newly presented live finger image and not with other templates. One reason for this is that the data capture process used to create a template is random. If two templates were created one after another for the same finger, each template would be different. This eliminates the possibility of database matching, and enhances privacy of user.

Shalini Varma S7 AEI

Read This Paper

by : Senanayaka, et.al.

in : *Robotics, Automation and Mechatronics, IEEE conference, April 2008*

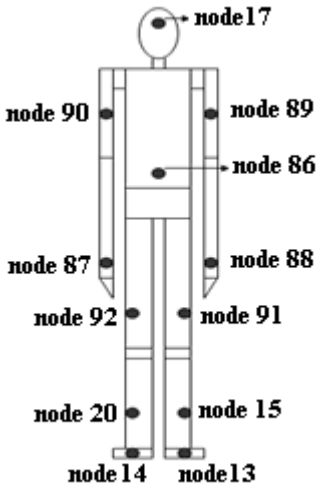
It's about

Human Motion Regeneration using Sensors

Human motion analysis is receiving increasing attention from computer vision researchers. This interest is motivated by a wide spectrum of applications, such as athletic performance analysis, surveillance, man-machine interface, content-based image storage and retrieval, and video conferencing. Three major areas related to interpreting human motion are motion analysis involving human body parts, tracking of human motion using single or multiple cameras, and recognizing human activities from image sequences. Motion analysis of human body parts involves the low level segmentation of the human body into segments connected by joints, and regeneration of the 3D structure of the human body using its 2D projections over a sequence of images. Tracking human motion using a single camera or multiple cameras focuses on higher-level processing, in which moving humans are tracked without identifying specific parts of the body structure. Understanding the human movements or activities based on the moving human image naturally comes after successfully matching the moving human image from one frame to another in image sequences. We will look at athletic performance analysis and regeneration technique in this write up.

The process of analyzing the gait or motion of subject is often referred to as motion analysis. Motion analysis, in this context, is the detailed study of human motion, in a certain task or within a certain area. Motion analysis methods are mostly dependent on vision systems. Vision system methods may not adjust and accommodate easily to major changes made in the environment or lighting condition of the area. These methods are time consuming and as such do not suit sports performance analysis. Therefore, this approach is often not practical in a sports monitoring/training situation. For such situations, sensor based motion analysis is used. This is very much useful to coaches as they obtain required results fast. Thus sensor based motion analysis helps sports performance enhancement and prevention of injury.

Accelerometers play an important role in short term supervised monitoring and long term unsupervised monitoring.Tri-axial accelerometers provide information on the acceleration in three directions, namely the vertical (Z-axis), anterior and posterior (Y-axis)directions and lateral direction(X-axis).



The accelerometers are placed on the test subject's body at points of interest, to measure the acceleration at those points. These are then strapped down to the test subject's body using elastic body straps. The accelerometers have to be securely strapped down to the test subject's body to ensure that the measurement obtained is purely due to the movement of the test subject and not due to the movement of the accelerometers within the body straps.

Placement of accelerometers on the test subject's body

Sensors establish communication with a PC via a USB base station, using very high frequency part of em spectrum of the order of 900 MHz as its communication medium. The USB base station attached to a computer enables end user to issue various commands to the accelerometers. Data got from accelerometers is then conditioned and converted into appropriate kinematical information, which then gets displayed in numerical or graphical form. An important feature of the system is that initial processes, data acquisition and data interpretation run on a single programming platform.

In order to display the results acquired from the accelerometer in terms of a regenerated motion, a stick figure is designed to function with the accelerometer control system. A stick figure is a simple type of drawing to depict the general form of humans, for displaying results of motion regeneration. All calculations for positions start from the tip of the right foot. Most drawings of the human body take the length of the head as the reference for calculating lengths of different parts of the body. The calculation for the stick figure involves simple trigonometric functions.

The initial point of reference is taken to be at node 14(the right foot) and moved upwards from that point to node 20, node 92, node 86, node 91, node 15 and node 13.

Continued on next page.....

Read This Paper:

by : *Kimmo Koli and Kari A.I.Halonen, CMRR enhancement techniques for current-mode instrumentation amplifiers*

in : *IEEE transactions on circuits and systems: fundamental theory and applications, vol. 47, no. 5, May 2000*

CMRR ENHANCEMENT TECHNIQUES FOR CURRENT-MODE INSTRUMENTATION AMPLIFIERS: A REVIEW

Common mode rejection ratio (CMRR), is an important performance parameter of any difference amplifier. It is the ratio of the differential gain to the common-mode gain, generally expressed in dB. It signifies the ability of an opamp to reject common mode signal, the signal which appears simultaneously at both its input terminals. The CMRR is of great importance when it comes to noise rejection.

For applications involving high CMRR, instrumentation amplifiers consisting of three opamps are generally used. It has a major disadvantage that the value of CMRR depends on the level of matching of some resistors. Matching can be achieved to a limited extent only. Current-mode instrumentation amplifiers can be used to overcome this problem. The method makes use of second generation current conveyors (CCII), which convert differential input voltage to equivalent current. This current is then converted back to voltage by a current to voltage converter. This configuration prevents the necessity of matching resistors for high common mode rejection. Current-mode instrumentation amplifier provides high CMRR even at low differential gains, and so can be used over a wide frequency range (note that, the gain-bandwidth product is a constant). But still, this configuration too, is not perfect. This is due to the transistor level mismatch in the CCII. The performance of the current-mode instrumentation amplifier can be improved by some modifications. This is described in the IEEE paper, CMRR enhancement techniques for current-mode instrumentation amplifiers, by Kimmo Koli and Kari A.I.Halonen. (IEEE transactions on circuits and systems-: fundamental theory and applications, vol. 47, no. 5, May 2000)

The contents of this paper include a small introduction on the classical voltage-mode instrumentation amplifier and its improved version working on current-mode, its common-mode rejection and three techniques to improve the CMRR. The methods mentioned here are, common-mode bootstrapping, output current subtraction and use of composite conveyors. The article also discusses the effect of forward transconductance on some of the CCII based circuits.

The first method of CMRR enhancement, common-mode bootstrapping, exploits the relation between common-mode rejection and power supply rejection. In this method the CCII supply voltage is forced to follow the common-mode voltage. This method has a limitation that, it cannot be used for low voltage applications. In the second method, the output current of one CCII is subtracted from the other. The current subtraction can be done either using opamps or by inverting the current using CCII. In the third method, the performance of the CCII is improved by constructing a composite current conveyor using two or more CCII.

The IEEE paper also presents experimental and mathematical proofs for the suggested methods.

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> The men who try to do something and fail are infinitely better than those who try to do nothing and succeed
>
> -Lloyd Jones

... Continuation from page - 9

This covers the calculation for the lower extremity of the human body. The next stage would be to propagate the calculation upward, using the node located near the hip (node86).With reference to the readings got from the node at the hip, the positions of the two arms are estimated using nodes 90 and 87 for the right arm, and nodes 89 and 88 for the left arm. The motion is regenerated and plotted in LabVIEW programming platform using graphical output option.

The motion of each joint on the stick figure is got from the acceleration-time profile. The acceleration-time profile is converted first to velocity-time profile. The displacement-time profile is also got by numerical integration. Number of sensors is minimized, and easy-to-wear sensors are used to minimize the set up time. The complete motion data of this system gets downloaded to a desktop PC via wireless USB base station. The proposed system demonstrates the use of accelerometers for motion analysis.

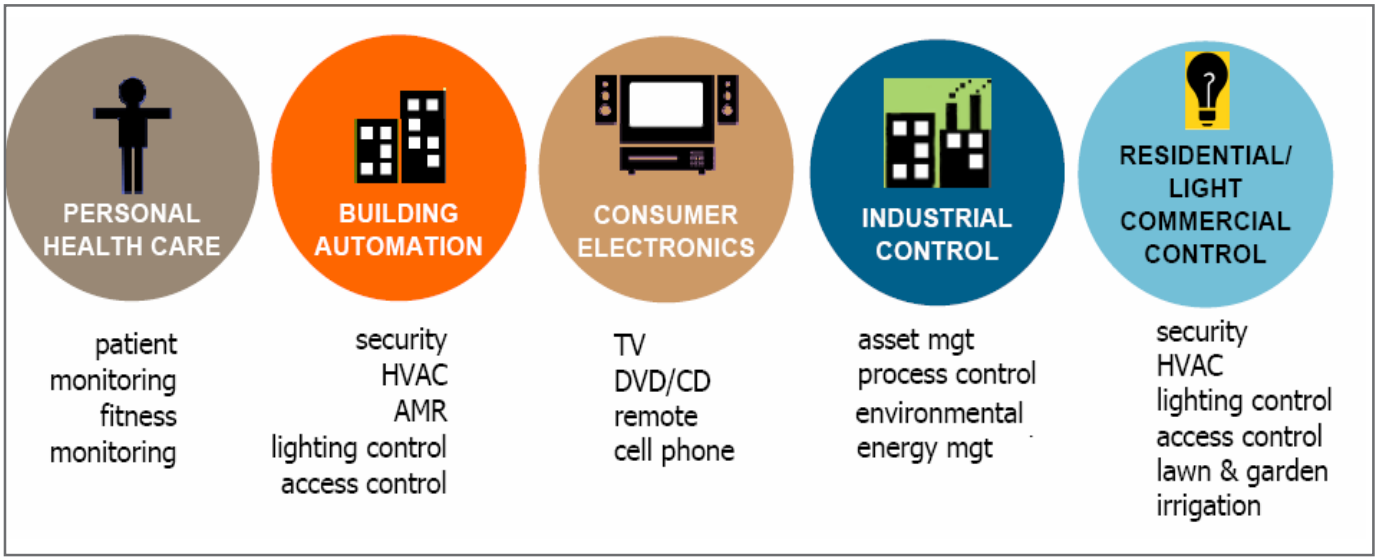
Mary Hexy

ZigBee

Over the last few years, we have witnessed a great expansion of remote control devices in our day-to-day life. Five years ago, infrared (IR) remotes for the television were the only such devices in our homes. And now? We run out of fingers to count the devices and appliances in our house which can be controlled remotely.

Operation of all these remotely controlled devices, can be made much smoother, easier and safe by putting them under a single standardized control interface that can interconnect them into a network, specifically a home-area network (HAN). One of the most promising HAN protocols is ZigBee, a software layer based on the IEEE 802.15.4 standard. This article is an attempt to introduce ZigBee and its applications to you .

There are many wireless options available to designers. Let's compare ZigBee with some of the more popular standards which share the unlicensed 2.4 GHz band. The parameters listed in the chart include the governing MAC standard, maximum over the air data rate, typical transmit and standby currents, memory requirements for a typical device, target applications and networking options. Bluetooth is a popular standard applied to wire replacement applications. It too is based on an IEEE PAN standard, 802.15.1. Bluetooth operates with a 1 Mbps data rate. Note that Bluetooth and ZigBee have similar transmit currents, but ZigBee has a significantly lower standby current. This is because devices in Bluetooth networks must frequently report into the network to maintain synchronization, so they cannot easily drop into



What is ZigBee

It is an emerging standardised protocol for Ultra Low Power Wireless Personal Area Networks (WPANs). Based on the IEEE 802.15.4 standard, the term ZigBee is used to describe a standardised wireless protocol for personal area networking, or 'WPAN'. The protocol is the work and property of the ZigBee Alliance, a consortium of more than 70 companies who have joined together to create and promote the new standard.

ZigBee is different from other wireless standards in that it has been designed to serve a diverse market of applications that require low cost, low power wireless connectivity with more sophistication than was previously available at the target price. The standard focuses on low data rate, low duty cycle connectivity, a market segment not serviced well by existing standards. The reason for promoting a new protocol as a standard is to afford interoperability among devices manufactured by different companies.

ZigBee alliance promoters include Honeywell, Phillips,

a 'sleep' mode. Wi-Fi is a wireless LAN standard, so it requires almost continuous activity by devices in the network. The advantage of this standard is the tremendous amount of data that can be moved from point to multi-point. Note the transmit and standby currents. Wi-Fi hardware is designed to operate off a significant power source. Of the three wireless standards, only ZigBee offers the flexibility of mesh networking. Also note the reduced memory requirements of ZigBee. ZigBee applications are typically simple. The power is in the networking, and ZigBee end devices can 'sleep' while still maintaining network association

The advantages of Zigbee include unrestricted geographic use, RF penetration through walls and ceilings, automatic or semi-automatic installation, ability to add or remove devices, and lower cost.

Jino M Pattery

Students' Page

Satellite telephones

There are confirmed reports that terrorists involved in Mumbai blast used sat phones for communication.

Most of us are not familiar with satellite telephones. It comes to daily use for those who work in ship, military, disaster management, etc.

Most mobile telephone networks operate close to capacity during normal times, and during emergency situations due to large call volumes, the telephone systems get overloaded. Satellite telephones are of use when we need congestion free, portable means of communication.

A satellite phone, or sat phone, uses a network different from that of normal mobile phones. These do not use transmitting towers, but makes use of satellites directly. A number of technical challenges are involved in devising a satellite phone system. Path length between earth and satellite introduces significant losses due to divergence. To minimise this, most of the systems use low earth orbiting satellites. But then, a number of satellites are to be used; each satellite will be in view only for a certain amount of time. It is therefore necessary even for a stationary phone to be able to change over from one satellite to another. There are service providers who make use of geostationary satellites as well like Aces, Inmarsat , Thuraya and MSAT.

Phones used for satellite communication are often larger in size. The antenna is often larger to ensure the required level of power. Any mobile phone requires speedy communication with the network to enable calls to be set up, controlled and finished. The round trip delay from the mobile to satellite and back to the earth is significantly long, and affects speed of communication and protocol exchanges. As a result, much of intelligence of the system has to be placed within the satellite so that the required protocol exchanges can take place fast.

A satellite phone doesn't rely on local telephone infrastructure to function. Because of this, they are used widely in regions which are disaster prone. Satellite phones are used widely in ships for communication. They are also used widely for communication in remote area where there are no mobile networks available.

There are many disadvantages; high cost of both the handset and call, and bulky handset are some. Satellite phone networks themselves are prone to congestion as satellites cover a very large area with relatively less number of voice channels. Sat phones are built for one particular network and cannot be switched to other networks.

For dedicated and critical channels, satellite phones are very effective. While popularizing more efficient and strategic technologies, government and people must make sure that they don't reach wrong hands. There are confirmed reports that terrorists involved in Mumbai blast used sat phones for communication

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✣u r iosity corner

Power rating of a standard T V set is 60W. Thus current rating is 260 mA. But the fuse rating of different manufacturers is in the order of 2 A. Why ?????.....

First correct answer will win a small prize

Answer to the question in the previous issue

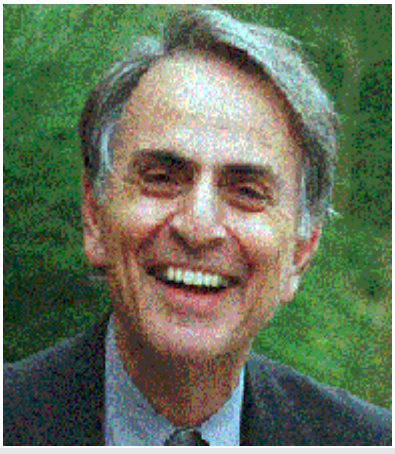
Googolplex

A **googolplex** is the number 10^{googol}, which means it's a 1 followed by a googol of zeros (i.e. 10^{100} zeros).

$$1 \text{ googolplex} = 10^{googol}$$

How big is a googolplex?

Carl Sagan estimated that writing a googolplex in numerals (i.e., "10,000,000,000...") would be physically impractical, since doing so would require more space than the size of the observable universe.



The time it would take to write such a number also renders the task implausible. If a person can write two digits per second, it would take around 1.1 × 1082 times the age of the universe (about 1.37 × 1010 years) to write a googolplex