# APPTRONICS review

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RSET
RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY

## Department of Applied Electronics & Instrumentation

Rajagiri Valley | Kakkanad |Kochi | Kerala | INDIA

# Table of Contents

1.) HoD speaks .....3

2.) Can you take it up?.....4
- *Prof. P. R. Madhava Panicker*

3.) VoIP.....4
- *Ms.M. Shanmugapriya*

4.) A picture is worth a thousand words.....5
- *Sheeba Breeze*

5.) Coronary Imaging Improves Identification of Plaques Likely to Cause Heart Disease .....6
- *Ms. Liza Annie Joseph*

6.) 3D Tracking Technology.....7
- *Nixon Varghese, S8 AEI*

7.) 3-D Reconstruction.....8
- *Keerthi Chacko, S8 AEI*

## HoD speaks…

*Most often there is a question lingering in the minds of young students-'where does an applied electronics and instrumentation engineer fit in?'*

*The scope of instrumentation engineering is vast, and appears to be growing, partly due to the increased use of automatic control in manufacturing and process plants, to some extent due to ever increasing application of instrumentation in communication instruments.*

*The primary focus of instrumentation engineering is the development and implementation of electrical and electronic instruments for the purpose of monitoring, measuring, and recording physical phenomena.*

*Demand for Applied Electronics is growing rapidly generating multi-faceted job opportunities for graduates. For example, these graduates can work as manufacturing engineers in MNCs producing electronics goods like Sony, LG, Samsung, and Philips; as quality and reliability engineers in process industries and large scale R&D organisations, and so on. Many firms need instrumentation engineers for consultancy. Graduate instrumentation engineers with the required skills can turn out to be excellent entrepreneurs. And for those who do not stop with graduation, who go for PG and doctoral work, chances are all the more bright. They can become good design engineers, good teachers.*

*The growth of instrumentation engineering is also tied with the development of more accurate and more robust sensors, which allows to detect phenomena of interest with much higher precision than what we could do a decade or two ago.*

*The field of Applied Electronics and Instrumentation Engineering is growing at a very fast pace. Over the past three decades, applications of instrumentation have spread to almost all disciplines of engineering. Mining & metallurgy, robotics, textile, rolling mills, cranes & hoists, arc furnaces, chemical engineering, process control, and static relays are a few examples of the disciplines which got blessed by the entry of instrumentation.*

*If you would like to gather more information on the educational and career opportunities for instrumentation engineers, visit the site of any of the professional societies for instrumentation like*

*Instrument Society of America, Instrumentation and Measurements Society of IEEE, Institution of Diagnostic Engineers (US), and the Institute of Measurement and Control (UK).*

## Department News & Events

***Placements:***

*The department is proud of its final year students as almost everyone got placed in Premier companies such as TCS, HCL, UST, ACCENTURE etc.*

***Training Programs:***

*The department successfully hosted a 3 month intensive training program during the period August- November 2010 on Process Control in technical collaboration with YOKOGAWA, a leading Industrial Giant in the field of Instrumentation and control.*

*29 students from various engineering colleges of Kerala attended the programme.*

***Short Term Courses:***

*To bridge the gap between the curriculum and the industry requirements, the department is always interested in conducting seminars and short term courses*

*-A five- day program on Programmable Logic Controllers and SCADA was conducted from 4th to 10th January 2011 for the final year Students of AEI department.*

*-A 18 hour program " LabVIEW Uses and Applications " was conducted for pre final year students to help them with their project work.*

*-To focus on the trends and latest developments in the field of Digital Signal Processing, the department took initiative in conducting a one day workshop for the Post Graduate Students on " Digital Signal Processors and their Applications" in collaboration with Texas Instruments.*

***Faculty Development Programs:***

*The department is keen on constantly improving the quality of the faculty and the supporting staff. In this connection, the department arranged the following faculty development programs which effectively helped the staff to become more thorough in subject basics and new trends.*

*"Basics of Operational Amplifiers" by Prof.P.R.Madhava Paniker.*

*"Dynamic Programming" by Dr.Abraham Thomas.*

***Achievements:***

*Ajay Augustine and Annmol Cherian, students of S8 AEI presented the paper titled "Thermal aware static power extraction methodology for nano- scale integrated circuits" in 'National Level Conferences and Innovations in wireless technology' held on 26th March 2011. This was based on their final year project work.*

*"If you only do what you know you can do- you never do very much."- Tom Krause*

# Can you take it up?

***Select your blouse piece at the click of a button.***

*It may seem to be crazy; but it is not.*

*Attention of ladies and husbands, sisters and brothers: How much time have you spent in textile shops looking for blouse piece matching with a sari? Didn't you feel it is a shear waste? I had to pity myself during an Onam season a few years back for spending more than an hour doing nothing else but waiting for my wife to come down from the third floor of a crowded 'textiles'. She was busy (unlike me!) with selecting a blouse piece matching with the sari which was already selected (that was done of course with my able support). And, finally when she came back, it was with a request to take her to another shop (to repeat the attempt for another record!).*

*I am sure that lakhs of man (woman!) hours are being wasted at textile shops for such a simple purpose alone. Let us put in a little effort to change the scenario. Let me propose the following.*

*Design and develop a hand held instrument of the size of the usual bar code reader. On a click of the instrument at the specific location on a sari it must memorise that hue. May be, you can provide option for saving a few more hues. Then, holding a button pressed, move the reader along the row of blouse pieces at a convenient distance from the rack. When a matching piece is identified, let it give a beep. It is not essential to pin point the exact match. Let it point out two or three close matches (dictated by the Q of your instrument), from which our great lady could pick one (or, may be all!) with a smile.*

*Hello! Wait a minute. I'm sure that you are an enthusiastic engineer, or at least an enthusiastic engineering aspirant. But, don't hurry up to start working out schemes. A suggestion has already come adding one more excellent dimension to the statement of the problem. The suggestion is to provide the textile shop fellow with one more feature in our system. Let the hues of all the blouse pieces available in the shop be saved in the device, or another connected device, so that the gun need not move on to the rack. Let it stay glamorously on the seat (on the table) and say where the matching pieces are located. You simply have to pick it up. That definitely removes the constraint of making it handheld.*

*You may discuss the advantages of both versions: a table top one and a hand held one. Why not decide on having both the versions to be offered?*

*Develop one. Transfer technology to industry. Let us not try to estimate how much money it could raise. Let us worry about it later.*

*Shall we take it up for design and development?*

*Shall we sit together for a discussion on how to go about doing it?*

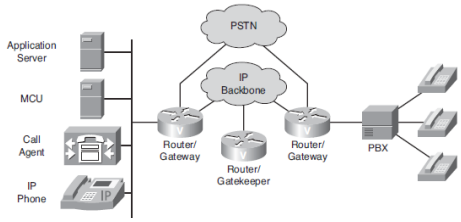
**- Prof. P. R. Madhava Panicker**

# VoIP

*Voice over IP is also known as VoIP. You might also hear VoIP referred to as IP Telephony. Both terms refer to sending voice across an IP network. However, the primary distinction depends on the endpoints in use. For example, in a VoIP network, traditional analog or digital circuits connect into an IP network, typically through some sort of gateway. However, an IP telephony environment contains endpoints that natively communicate using IP.*

*VoIP routes voice conversations over IP-based networks, including the Internet. VoIP has made it possible for businesses to realize cost savings by utilizing their existing IP network to carry voice and data, especially where businesses have underutilized network capacity that can carry VoIP at no additional cost.*

**Components of a VoIP Network**




■ **IP Phones:** *IP Phones provide IP endpoints for voice communication.*

■ **Gatekeeper:** *A gatekeeper provides Call Admission Control (CAC), bandwidth control and management, and address translation.*

■ **Gateway:** *The gateway provides translation between VoIP and non-VoIP networks, such as the PSTN. Gateways also provide physical access for local analog and digital voice devices, such as telephones, fax machines, key sets, and private branch exchanges (PBX).*

■ **Multipoint Control Unit (MCU)***: An MCU provides real-time connectivity for participants in multiple locations to attend the same videoconference or meeting.*

■ **Call agent:** *A call agent provides call control for IP phones, CAC, bandwidth control and management, and address translation. A call agent typically runs on a server platform. Cisco Unified Communications Manager is an example of a call agent.*

■ **Application servers:** *Application servers provide services such as voice mail, unified messaging, and Cisco Communications Manager Attendant Console.*

■ **Videoconference station:** *A videoconference station provides access for end-user participation in videoconferencing. The videoconference station contains a video capture device for video input and a microphone for audio input. A user can view video streams and hear audio that originates at a remote user station.*

■ **PBX***: A PBX (Private Branch Exchange) is a small telephone switch owned by a company or organization. These organizations purchase PBX's to reduce the total number of telephone lines they need to lease from the telephone company. Without PBX, a company will need to lease one telephone line for every employee with a telephone.*

**IP Networking and Audio Clarity**

*Voice over IP (VoIP) introduces additional challenges into a network design. Some of these challenges stem from the necessity of providing a perceptible level of voice quality to end users, while efficiently using available bandwidth.*

*Because of the nature of IP networking, voice packets sent via IP are subject to certain transmission problems. Conditions present in the network might introduce problems such as echo, jitter, or delay and packet loss. These problems must be addressed with quality of service (QoS) mechanisms.*

■ **Echo:** *Echo is a result of electrical impedance mismatches in the transmission path. Echo is always present, even in traditional telephony networks, but at a level that cannot be detected by the human ear. The two components that affect echo are (1) amplitude (loudness of the echo) and (2) delay (the time between the spoken voice and the echoed sound).*

■ **Jitter:** *Jitter is variation in the arrival of coded speech packets at the far end of a VoIP network. The varying arrival time of the packets can cause gaps in the recreation and playback of the voice signal. These gaps are undesirable and annoying to the listener.*

■ **Delay:** *Delay is the time between the spoken voice and the arrival of the electronically delivered voice at the far end. Delay results from multiple factors, including distance (propagation delay), coding, compression, serialization, and buffers.*

■ **Packet Loss:** *Voice packets might be dropped under various conditions such as an unstable network, network congestion, or too much variable delay in the network. Lost voice packets are not recoverable, resulting in gaps in the conversation that are perceptible to the user.*

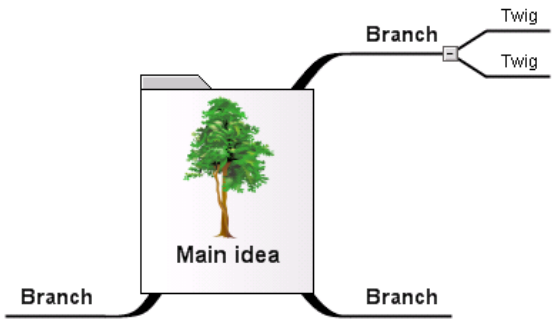
**- Ms.M. Shanmugapriya**

# A picture is worth a thousand words

*Do you feel that energy and time are wasted writing down words after words as notes and reviewing it? More important, do you feel that notes harm memory? Then, probably Mind Mapping is a phrase you shall not miss out.*

*Mind mapping is a highly effective way of getting information in and out of the brain. It is a creative and logical way of note-taking and note-making. Here, you 'draw' notes, rather than write them, or in other words, you make an image which consists of figures and key words.*

*The next figure could depict the concept.*




*Mind maps have a structure which branch out from a central idea. These maps use lines, symbols, words, colour and images based on simple and brain-friendly concepts.*

*A mind map could be compared to the map of a city. A central place in the city represents the main idea, main roads represent the branches, secondary roads represent the twigs and so on. Branches in the image form the key thoughts, the twigs secondary thoughts, etc. They could be extended further outward. Special images and shapes are also used as landmarks of interests, or as key areas.*

**How does this mind mapping help?**

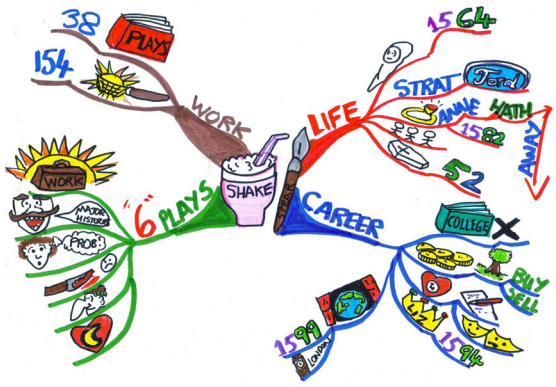
*The answer to this question lies in the way brain works to process information. Any bit of information entering the brain can be represented as a central sphere and from there, thousands of associations are taken to other sites in the brain. These associations, also termed hooks get connected to sites which could have their own infinite array of links and connections. We may imagine the brain in this context to be a gigantic Branching Association Machine. The concept of radiant thinking originates from this mode of information processing. Mind mapping is a manifestation of this radiant thinking.*

*Preparation of proper notes shall definitely help you learn better and mind mapping must be an effective tool to help you do it as it improves the ability of brain to*

- *make the essence of the note easily evident*
- *make the relative order of information visible*
- *make connections between ideas obvious, and*
- *boosts our confidence.*

*In short, mind mapping keeps 'love of learning' alive.*

*Here's an example of Mind Mapping done based on William Shakespeare's life.*




**- Sheeba Breeze**

## Coronary Imaging Improves Identification of Plaques Likely to Cause Heart Disease

*Findings from a major clinical trial provides new clues into the types of vulnerable plaques that are most likely to cause sudden, unexpected adverse cardiac events , and on the ability to identify them through imaging techniques before they occur.*

*The trial, Providing Regional Observations to Study Predictors of Events in the Coronary Tree (PROSPECT), is the first prospective natural history study of atherosclerosis using multimodality imaging to characterize the coronary tree.*

*Atherosclerosis is a common disorder that specifically affects the medium and large arteries. It occurs when fat, cholesterol and other substances build up on the walls of arteries and form hard structures called plaques.*

*Eventually, the plaques can make the artery narrower and less flexible, making it harder for blood to flow. If the coronary arteries become narrow, blood flow to the heart can slow down or stop.*

*The trial was a collaborative effort being done at a few research centres. It involved examination of patients with acute coronary syndromes (ACS) using three-vessel multimodality intracoronary imaging - angiography, gray scale intravascular ultrasound (IVUS), and radiofrequency IVUS - to quantify the clinical event rate due to atherosclerotic progression and to identify those lesions that place patients at risk for unexpected cardiovascular events (sudden death, cardiac arrest, heart attacks, and unstable or progressive chest pain).*

*Findings of the trial include, among others, a special one of interest to us: most untreated plaques that cause unexpected heart attacks are not mild lesions, as previously thought, but they have large plaque burden and/or small lumen area. These are characteristics that are invisible to the coronary angiogram but easily identifiable by gray scale IVUS. Moreover, it is demonstrated that characterization of the underlying plaque composition (with radiofrequency IVUS, also known as VH-IVUS) is able to considerably improve the ability to predict future adverse events, compared to other more conventional imaging techniques.*

*These results mean that using a combination of imaging modalities, including IVUS, it is possible to identify lesions with large plaque burden and/or small lumen area and those which are at especially high risk of causing future adverse cardiovascular events.*

**- Ms. Liza Annie Joseph**

*(News items from* **Medimaging International.***)*

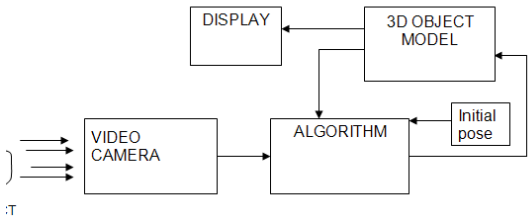
STUDENTS PAGE

# 3D Tracking Technology

*3D-tracking is the process of locating objects in 3D space based on their 2D images. It has a long tradition in computer vision research with many applications, such as robot navigation and human motion analysis.. The essential inputs to a 3D tracking system are the video of the moving body to be tracked, and an object model for that body. Object model is a computer generated model of the object to be tracked. A video consists of a series of still images. Each still image forms one frame. Movement of one object, through movement of the image, is got by running these frames at specified speed.*

## A general 3D tracking system

*Block schematic of a general 3D tracking system is given in figure.*




*The video of the object to be tracked and its object model are fed to the algorithm. The algorithm then generates 2D to 3D point correspondences between the incoming frame and the object model.*

*These point correspondences are complex mathematical expressions and are found and processed with the help of computers. The point correspondences of the first frame must be established and given as input.*

*There are two classes of algorithms namely region based technique and motion based technique.*

### i) Region based technique

*In this technique, the object region is extracted through image segmentation process and is made to overlap with the corresponding 2D surface got by projection of the object model.*

*The technique attempts to minimize the overlap error.*

***Motion based technique***

*Two approaches are being adopted in this, mainly the optical flow approach and the scale invariant feature transform (SIFT) approach.*

***Optical flow approach***

*Here again, the approach is based on comparison- comparison of the optical flows got from the images and the object model.*

*Optical flow is the pattern of motion of the object. This pattern is got based on specific features like edges, in visual scene.*

*Optical flow field is derived making use of successive frames. Attempt is to get the optimal field.*

*This method is very much sensitive to brightness changes and is restricted to small pixel displacements.*

### ii) SIFT (Scale Invariant Feature Transform)

*Scale-invariant feature transform (or SIFT) is an algorithm in computer vision used to detect and describe local features in images. The SIFT method involves the following steps:*

*- Key features in the frame are found. Key features include sharp changes in brightness, color, intensity etc.*

*- Feature points lying outside the object model are removed.*

*- Remaining points are used for comparison between successive frames to obtain 2D-3D correspondences.*

*Very recently an object tracking technique has been introduced which combines all the above techniques. All three concepts are chosen such that the shortcomings of each one are compensated to a great extent by the others. Tracking by the object region can prevent the accumulation of errors. Optical flow and SIFT can handle larger transformations. Whereas segmentation works best in the case of homogeneous objects, optical flow computation and SIFT tracking, rely on sufficiently structured objects. A sensible combination yields a general tracking system that can be applied in a large variety of scenarios without the need to manually adjust weighting parameters.*

*There is a confidence measure estimated for the information from each technique. More the confidence measure more the weightage given to the information from that technique. From the correspondences found, the motion of the object model is estimated using the pose estimation minimization problem.*

*Reference:*

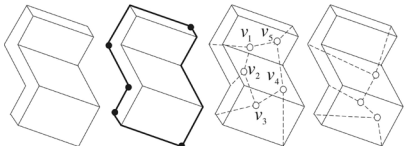
*Thomas Brox, Bodo Rosenhahn, Juergen Gall,Daniel Cremers, "Combined Region and Motion Based 3D Tracking of Rigid and Articulated Objects ," IEEE Trans. Pattern Analysis and Machine Intelligence vol. 32,No.3,pp 402-415,March 2010.*

**- Nixon Varghese, S8 AEI**

## 3- D Reconstruction

*The human vision system can interpret a single 2D line drawing as a 3D object without much difficulty even if the hidden lines of the object are invisible. Though there reconstruction method of 3D CAD model could be done based on multiple views, here we will reconstruct a 3- D from only one view. This paper proposes an approach to reconstructing a complete 3- D object, including the shape of the rear side of the object, from a line drawing without hidden lines. First, we develop the theoretical constraints and an algorithm for the inference of the invisible edges and vertices of an object. Then, we present a reconstruction method based on perceptual symmetry and planarity of the object.*

*Outline of the algorithm*




*Step 1: Compute the degrees of all the vertices and the ranks of all the edges from the line drawing. An edge of a line drawing is the intersection of two non- coplanar planes. The degree of a vertex v is the number of edges meeting at v in a line drawing.*

*Step 2: Find boundary cycles and incomplete vertices. An incomplete vertex v is a vertex of degree 2 (for a 3- D object).*

*Step 3: Construct an initial hidden structure. Connect each incomplete vertex to a different hidden vertex. Two hidden vertices are connected if their corresponding incomplete vertices are closest on the boundary cycle.*

*Step 4: Reduce the initial hidden structure to the most possible one according to human visual perception of the 3D object, by using cutting and merging processes. Cutting one edge on a hidden cycle removes this edge from the cycle while keeping the two vertices of the edge. After the cutting, the two hidden vertices of the edge are connected by only two hidden edges.*

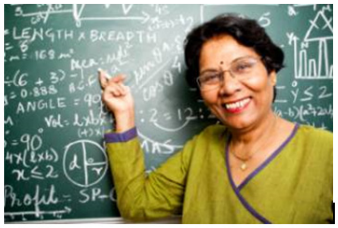
*All the possible hidden structures with least number of hidden vertices are found. Then the most possible structure is found using Gestalt laws of symmetry. Now from these inferences of hidden structures we reconstruct the object.*

*We need to derive the 3D coordinates of all the visible and hidden coordinates. We present an optimization- based method to recover the 3D shape of the complete object, for which we develop an objective function for this purpose. The function contains three components a measure of symmetry (measure of how closely the invisible part resembles the visible part), standard deviation of all angles from vertices based on Marill's approach, deviation from planarity. Based on the above analysis, the objective of reconstruction is to maximize symmetry while minimizing planarity deviation and standard deviation from all angles. The future work includes handling curved objects and more complex polyhedra.*

**- Keerthi Chacko, S8 AEI**

*Inaugural function of the three- month Process Control and Instrumentation Training programme for students on Aug 18 2010*

## Curiosity corner



*It is generally felt that female voice gets less attenuated with distance traversed. Have you experienced it? If not, why not go to a class being taken by the owner of a feeble female voice, sit in the rearmost row, and experience?*

*How can it be true!*

*Sound travels as elastic waves of the medium, as compressions and rarefactions. Air has too poor elastic properties to carry acoustic waves over long distances. Also attenuation increases with frequency. That is why ultra sounds cannot traverse much through air. Also, you and I are very sure that female voice has more contents compared to male voice. Is it not a puzzling topic?*

*Post your thoughts to Apptronics.*