

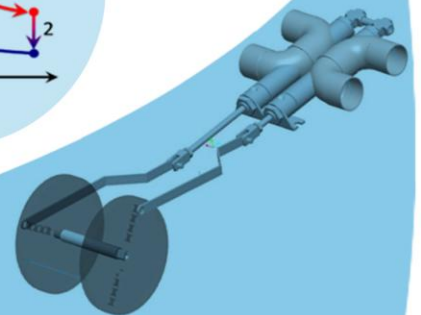
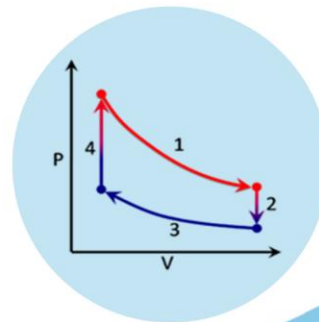


Anna University  
Madras Institute of Technology



# INSTRUE

VOL 5.0 MAGAZINE



A Thermoconverter to increase the efficiency by 0.13% - Pg. 12 !



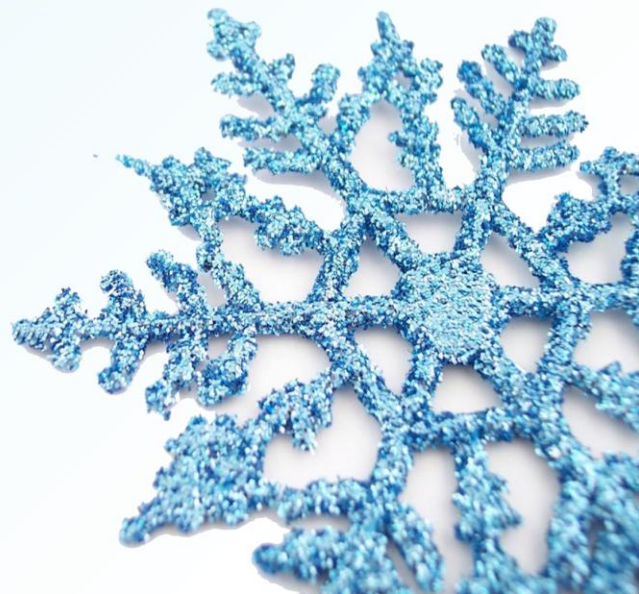
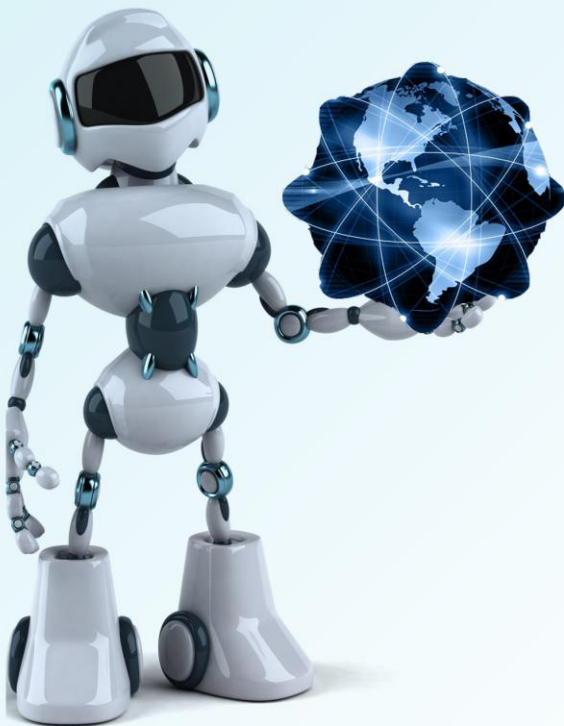


# INTECHO '14

*Automation - the next step to Utopia*



THIS YEAR, INTECHO IS BACK WITH A THEME THAT ELATES EVERY ENGINEER.  
A THEME EVERY INDUSTRY STRIVES TO ACHIEVE.  
A THEME EVERY PERSON EXPERIENCES EVERY DAY.





## ACKNOWLEDGEMENT

We fold our hands to the almighty for making this magazine Instrue v5.0 a reality. We are thankful to Dr.S. Thamaraiselvi, the Dean, MIT for providing a platform to bring about this magazine. We are grateful to our Head Dr.J. Prakash for his trust and support in the outcome of the magazine. We thank Professor Emeritus Dr.P. Kanagasabapathy, who was the instrument in initiating the magazine. All the staff members have been a great pillar of support and strength throughout, to the entire magazine team. We are obliged to them. We ought to express our gratitude to the alumni for the helping hand.

We thank and appreciate all our student friends without whom 'INSTRUE' would have just been a dream.

- **Team Instrue**



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## DEAN'S DESK

Nothing, but making my students get into their world of interest can give me the greatest pleasure. I believe that the magazine “Instrue”, by the students of Instrumentation Engineering will serve as one helping hand among many. I hope it will instil many great new ideas in the young minds and I am sure that it is one right platform for the budding engineers to unleash their creative thoughts. I wish the magazine and the students a great success.

Dr.S.Thamarai Selvi

Professor and Dean, MIT



## HOD'S DESK

A young innovative mind is always a fertile breeding ground for everyday updates. Besides theoretical knowledge, a pragmatic approach is essential to remain in today's contention. I feel proud that our Instrumentation Engineers have brought forth a technical magazine 'Instrue' that can help the growing technocrats to get some knowledge under their belt in the field they desire. It would also mark a way towards their career. I wish every one of you to be the best version of yourselves.

Dr.J.Prakash

Head of the Department

Dept. of Instrumentation Engg, MIT.





## EDITORIAL MESSAGE

Hello Engineers!

We are delighted to release the 5th version of the technical magazine – Instrue v5.0 on this august occasion of Intecho' 14, the annual national level technical symposium of the Department of Instrumentation Engineering, MIT, Anna University. You would not be holding this if it is not for the team comprising of sub editors, designers and writers from all years of the department. The team has laboured over the past two months and we feel ecstatic in what we have achieved. I would like to thank and congratulate the entire team for doing such a fine job.

**Automation – The next step to Utopia!** An Engineer would not require anything more to furnish his attention. Let me tell you first, why we chose the theme of Intecho' 14 as Automation. Now for that, we need to go for a little recap. In 1949, Shri C. Rajam, a visionary, founded MIT with four new and never-heard-of specializations in the field of Engineering. 'Instrument Technology' is one among them. The man must have been a genius for that he knew how significant Instrumentation would become in the time to come. A salute to his prudence! It was indeed a curtain-raiser. Today, Instrumentation forms the fertile breeding ground for all fields to flourish.

What is the ultimate goal of Instrumentation? – **Measurement and Control!** Over the years, the control aspect of Instrumentation has progressed and has now evolved as Automation. And we, the Instrumentation Engineers strive to achieve this – the **Automation!**

It all started in the 18<sup>th</sup> century when continuous corrective action was required in the centrifugal governor. Now, what we call as the corrective action needs an instructor to correct it every now and then: the feedback or sequential control. Feedback type of control forms the crux for Automation. Let me give you an analogy of my own. Ever wondered how our moon comes with us everywhere? The moon is the best control system in the world. Every time you make a move (a disturbance), your position is sensed (transducer), and fed back to the system (the moon) and the change is tracked. Well, you can test it! Such neck-to-neck control is not possible even with today's advancements. We, the technocrats, dream to make such impossible neck-to-neck control possible, for the word "Impossible", says by itself that "I'm possible".

Every process industry in the world employs Automation. Consider the fertilizer industry wherein the ratio of reactants combining is crucial to obtain the product in the desired state. Remember, the reaction  $1\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$ ? The ratio 1:3 of nitrogen and hydrogen is vital and is to be maintained throughout the process. An automated reactor with accurate flow control can accomplish this. Automation improves throughput, saves energy, and ensures quality, accuracy and precision. Automation is now used in industries to perform tasks that are beyond human capabilities. Industrial robots are being used for mining, agriculture, retail and even waste management.





Automation has also extended its hands to homes. Tired of adjusting the regulators every now and then? Have you always imagined your fan with some sixth sense that would rotate at a speed to deliver the right amount of coolness you require? It is high time that all our imaginations become reality. Based on the ambient temperature, the speed of the fan would adjust itself! How about switching off lights whenever daylight is sufficient? Now, that also saves energy. Thanks to Automation for that it has made our lives cozy and comfortable.

Directly or indirectly, each and every one of us is benefited by Automation. Development is alone supreme. We feel supreme in bringing to you Instrue v5.0 which we hope will instigate many thoughts on development. I wish all Engineers the very best to strive for a better tomorrow to live in – **A world of Automation.**

## The Editorial Team.

### MIT FACT

- *MIT is the first self financing college in India*
- *MIT was started in 1949, offering four courses with 'Instrument Technology' being one among them.*
- *That makes The Department of Instrumentation, MIT one of the oldest and the first of its kind in India.*

## TEAM INSTRUE

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## USEFUL TIPS TO FARE WELL IN THE INTERVIEWS

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*Chairman-IEEE Madras Section 2010& 2011)*



### DR. K. ARUNACHALAM, DR. S.BOSE

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### TIPS TO FACE INTERVIEWS

- Prepare a comprehensive resume.
- Read list of questions often asked by interviewers, prepare the answers and practice them
- During the interview, relax and avoid showing your nervousness obvious
- Speak loudly, clearly; sit up straight; try to look at the interviewer's eyes when you speak to him/her
- Be honest in your approach
- Keep your answers brief and to the point. Do not give 'yes' or 'no' replies.
- Don't discuss your personal difficulties.
- Show your enthusiasm and willingness.
- Exhibit your skills and abilities.
- Practice with Mock GD / Mock Interview / Aptitude Test etc.,
- Visit the website of the company before attending the Pre Placement Talk (PPT) to get clear idea
- Regularly view the Placement Notice Board
- Update your database after revaluation / arrear result
- Prepare well in fundamental subjects of respective branches
- Be punctual for Pre-Placement-Talk as well as for Test / Interview
- Occupy first benches also, during the PPT; maintain Gender separation and discipline during PPT
- Carry Pen, Pencil, Eraser, Passport Size Photograph etc., for the test
- Carry Resume / Copy of Mark Sheets / Community / Co-curricular / Extra-curricular Certificate etc for the interview
- Prepare in advance, the questions you want to ask about the job and company
- Avoid wearing Jeans / T-shirts/Cheppal / Half sleeves
- Attend the interview with clean dress (tucked-in) and neatly shaved to maintain dignity and decorum





- Maintain Professional ethics and moral standards
- Bring doctor certificate for differently-abled physique
- Inform at the beginning itself about colour blindness, hearing disorder to avoid disqualification at the end.
- Avoid passing bad comments /Remarks about the College/ University/ Staff during the interview
- Do not exhibit bad mannerism during the placement activity
- Wish the interviewer while entering the room. Thank the interviewer before leaving the room
- Be available till the announcement of results and maintain silence during announcements of results

## FREQUENTLY ASKED QUESTIONS: (NON-TECHNICAL)

- What are your long range goals, ambitions, future plans?
- What do you want to be doing 5 or 10 years from now?
- How do you feel that you can contribute to this job?
- What are your hobbies?
- What are your strengths? Your weaknesses?
- Tell me about yourself
- What are your big accomplishments?
- What are your special abilities?

- What do you know about our company?
- What is your career goal?
- Why are you applying for a job with us?
- Do you have any questions?
- Do you want to pursue higher studies?
- What kind of job profile you enjoy the most, the least and why?
- I have interviewed others for this job, why should I give you the job?
- Can you tell me anything about yourself that you think I might want to know?
- Can you handle criticism? How do you deal with it?

## HR- EXPECTATIONS

- Attentiveness in listening to the questions
- Sincerity and honesty in the answers
- Body language: gesture, posture, eye contact and confidence level
- Positive approach in answering the questions
- Exhibition of skills, accomplishments and talents
- Enthusiasm and motivation level
- Command over communication skills
- Willingness and positive approach
- Stress handling capability

## BLOOMING WISHES FOR ALL YOUR ENDEAVOURS

### TRIVIA

- ✓ *The building of the Panama Canal, which links the Atlantic and Pacific Oceans, was one of the most difficult engineering projects ever. It is estimated that over 25000 workers lost their lives during the long and dangerous project, with most dying from disease and landslides.*
- ✓ *The oceans, which cover almost 71 percent of the Earth's surface, contain close to 20 million tons of gold.*





## WIRELESS SENSORS

### DR. P. KANAGASABAPATHY

*Professor Emeritus*

*Dept. of Instrumentation, MIT*



Wireless sensors are measurement devices equipped with transmitters to convert signals from conventional transducers into a radio transmission. The radio signal is interpreted by a receiver at a convenient location, which then converts the wireless signal to the desired form such as an analog current for data analysis.

### BENEFITS OF WIRELESS SENSORS

a) Safety: wireless sensors can be used in locations that are difficult to access due to extreme conditions such as high temperature, pH, pressure etc. Operators can continuously monitor the process in hazardous environment.

b) Convenience: wireless sensors can be used to form a web/network that would allow an engineer to monitor several locations, from one station. A number of wireless sensors have the ability to create a unique web page making up-to-the minute data, accessible anywhere in the world.

c) Reduced cost: wireless process control can reduce the cost of monitoring and controlling an industry by eliminating the need for extending the wire, conduit and other costly accessories.

d) Easy installation: As wiring is not required, the installation of wireless sensors becomes an easier task.

e) Online monitoring: Online wireless system receives sensor information, checks against net thresholds and sends alert messages through email or sms text.

### SELECTION OF WIRELESS SENSORS

The factors to be considered are:

a) Type of measurements: It is important to understand what is being measured and the ambience in which it is measured. The most suitable sensor should be selected for the given application.

b) Accuracy and Response time: Most of the wireless sensors are as accurate as their wired counterparts. However, the readings are typically transmitted within few seconds to preserve battery power. If instantaneous measurement is necessary, the transmitter/receiver should be chosen accordingly.

c) Range: The range of wireless sensors varies widely. Some are designed for short-range (indoor applications) of a few hundred metres, while other sensors can transmit data to a receiver located several kilometres away. The range of a wireless signal is always limited by obstructions.

d) Frequency: The frequency of radio transmission varies from country to country. In USA, 915 MHz and 2.4 GHz are the major frequencies allotted for industrial use.

### TYPES OF WIRELESS SENSORS

Several types of wireless sensors are available in the market.

a) Wireless sensor with a transmitter and a receiver: The standard form contains just a transmitter at the measuring end and a receiver at a remote location.

b) Wireless sensor with controller: The controller is inbuilt in the receiver. This can manipulate a process variable based on the data received. For example when a furnace is too hot, the remote controller can send a signal to turn off some heating element.





c) **Wireless sensor with data logger:** Wireless data loggers can remotely monitor temperature anywhere and transmit the data back to an engineer. These miniature wireless sensors are useful in applications that involve a roaming element such as food items being shipped. By packing a wireless data logger within a shipping container, a vendor or transporter can ensure and certify that products are refrigerated all the way to a distributor or grocery store.

d) **Wireless sensor with transceiver:** Transceivers can contain both a transmitter and a receiver in a single unit. These transceivers are located in between the conventional transmitter and receiver. The ability to rebroadcast the signals makes wireless transceivers extend the range of wireless measurement network.

#### WIRELESS SENSOR DATA MINING (WISDM)

The WISDM is concerned with collecting the sensor data from smart phones and other modern mobile devices (e.g., tablet computers, music players, etc) and mining this sensor data for useful knowledge. Currently the effects are mainly focused on the accelerometer and GPS sensor data from these devices, but it is possible to mine the audio sensors, image sensors, light sensors, proximity sensors, temperature sensors, pressure sensors, direction sensors and various other sensors that reside on those devices.

The activity recognition helps to recognize many of the physical activities that a smart phone user is performing walking, jogging, etc based on the user's movements, as measured by the smart phone's tri-axial accelerometer. The ANTI-TRACKER service will permit the user to track the activities that

they or their family perform, via a web-based service. The accelerometer based biometric information also helps to identify the user based on his /her accelerometer data.

#### RESEARCH WORK IN WIRELESS SENSORS

a) **Wireless IC sensors with ultra- low power transmitters and receivers** are being developed. These IC sensors include transmitter and a tiny antenna.

b) **Low power, high performance frequency sources and clocks** are being developed using FBAR resonators. These devices provide superior performance over existing technology. This technology opens up the possibility of true thin-film frequency references, allowing robust peer-to-peer wireless communication.

c) **Wireless animal tracking:** Wireless devices that can be worn by small birds in the field for several weeks at a time help to provide previously unavailable data to animal researchers. The use of off-the-shelf electronics helps to integrate WSL chips and energy harvesting technology to realize significant improvement in functionality and battery life.

d) **Recent developments in neuroscience and brain-computer interfaces** has led to the vision of implantable closed loop brain-computer interfaces for assisting persons with disabilities. To make this possible, brain interface chips that can be chronically implanted while wirelessly transmitting and processing massive amount of data are necessary. Significant progress has been reported in this extremely challenging problem.

#### DID YOU KNOW?

- *Tea is said to have been discovered in 2737 BC by a Chinese emperor when some tea leaves accidentally blew into a pot of boiling water. The tea bag was introduced in 1908 by Thomas Sullivan of New York.*





# RECENT TRENDS IN AUTOMOTIVE ELECTRONICS

**DINESH KATHIR RAJ. M**

*An Alumnus of MIT*

*Graduate Engineering Trainee,*

*Embedded Systems,*

*Renault Nissan Pvt. Ltd.*

## INTRODUCTION

India is facing lot of problems due to an increasing number of vehicles added on to India's roads every day. The main problems associated are congestion, parking problems, pollution and recycle-ability of the vehicles. There is also a shortage of petroleum in India and hence there is need for alternative fuels. Hence, solutions such as fuel cell and battery operated vehicles are to be explored. Sensors such as tyre pressure sensors can be useful in increasing fuel efficiency.

## ECO-DRIVING

Eco-driving is also an important concept which involves driving for optimum efficiency. Electronic Control Units (ECU) can be designed to provide optimum driving conditions which increase the efficiency. For example, an ECU can be designed to accelerate smoothly and brake gradually. There are also challenges involved in the development of electric vehicles mainly with regard to battery efficiency.

Areas such as firmware, dedicated intelligence chips and ECU's are in demand in the Automotive Electronics industry. The recent trends in the Automobile Industry highlight the scope for electronics in the Industry. On an average, any automobile has about 50 ECU's.

13% of the manufacturing cost includes cost for software. 35% of the cost of a car comes from the electronic units involved in it. Also, 80% of the automotive innovation in the recent years has been from Automotive Electronics.

## VEHICLE WIRING

Vehicle wiring has been an important aspect of discussion as well. Vehicle wiring can be reduced through in-vehicle networks. Plug and

play devices for vehicles are to be thought of, which will be in demand in the near future. Also, there are safety related issues in the present vehicles and hence there is a need to build different electronics sensors and other systems that enhance the safety. Intelligent sensors which monitor the driver activity and look for accident causing situations can be thought of.

## DIAGNOSTIC PROTOCOLS

Also, diagnostics plays an important role in the life cycle for the newer generation vehicles. Sometimes, the cause of malfunctioning of a component is not known. Hence On Board Diagnostics (OBD) units would help to diagnose any malfunctioning component. This can make use of Open Diagnostics Data Exchange (ODX). Also, design for diagnosability is being carried out in the recent years. The diagnostics protocols are pre-defined. From a test and measurement perspective, these developments boil down to three major areas that engineers will need to pay more attention to:

1. Increasing demand for more interactive systems that respond real time, requiring more data to be transmitted at ever increasing speeds

=> **implementation and test of higher-speed serial buses**

2. Increasing complexity and requirements for interoperability, including the proliferation of RF-enabled functions throughout the vehicle

=> **tests to ensure interoperability across analog, digital, serial, and RF data**

3. Increasing EMI challenges, for the "overall system to work with itself," and to meet EMI requirements





**=> EMI debug and test**

All three of these areas point to an increased need for test expertise and debug tools that meet these needs.

**HUMAN-MACHINE INTERFACE**

Human-Machine interface is one of the newly introduced technologies in the vehicles. Features such as hologram HUD, Auto pilot and cruise control can be implemented on real-time engines. Transportation Information Systems are also an area where newer innovations can be thought of. They include transport data management, transport network overlays, fuel and emission data management and identification of gross polluting

Since there has been an exponential growth in the field of automotive electronics, there is a need for standardization as well. The software layer as integration platform and the application interfaces that follow a particular standard are to be designed. There is a need for common architecture since integration of

functional modules from different suppliers is to be done. Multicore controllers could also be implemented for computation intensive applications in the vehicles. AUTOSAR (Automotive Open System Architecture) architecture by Robert Bosch is important in this regard. Communication protocols and interfacing technology are yet to be standardized.

**CONCLUSION**

To help facilitate innovation, it is also important to challenge the boundaries that limit us. Also, there can be structured innovation wherein a framework is defined for innovation. The above mentioned issues contribute to major areas wherein innovation can be achieved in the area of Automotive Electronics. Several of the above mentioned problems are yet to find a solution and hence I believe this article can get into the minds of the reader which can lead to brainstorming which can lead to newer innovations in the Automotive Electronics industry.

**DID YOU KNOW?**

- *The ant can lift 50 times its own weight, can pull 30 times its own weight and always falls over on its right side when intoxicated.*
- *Many hamsters only blink one eye at a time*
- *The Hawaiian alphabet has 12 letters.*
- *A cockroach will live nine days without its head, before it starves to death.*
- *Fleas can jump up to 200 times their height. This is equivalent to a man jumping the Empire State Building in New York.*
- *Koala bears almost exclusively eat only eucalyptus leaves and nothing else.*
- *Beware an ant uprising! There are one million ants for every human in the world. These resilient creatures also never sleep and do not have lungs.*
- *Humans have explored less than 10 percent of the Earth's vast oceans*
- *The Earth's softest known mineral is talc. Talc is used in a variety of ways, including as a glaze in ceramics and as filler in paper.*
- *The oceans, which cover almost 71 percent of the Earth's surface, contain close to 20 million tons of gold.*





# THERMO CONVERTER EXHAUST HEAT RECOVERY SYSTEM

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## INTRODUCTION

A vehicle is set into motion due to combustion taking place in the cylinder. But the energy developed in the cylinder is not entirely used for locomotion. A part of it is used to run an alternator for charging the battery. Here, we propose a model of an engine which charges its battery with the help of heat available at the exhaust. A Stirling engine can be made to run by the heat available from the exhaust and this can be used to run the alternator. Thus fuel consumption is reduced and efficiency can be increased. The main objective is to use the waste heat rejected in an IC engine and hence convert it to useful work. The waste heat rejected constitutes about 40% of the total heat produced in the engine.

## WORKING PRINCIPLE

The concept is to trap the waste heat rejected in the exhaust gases and to convert into useful work. The heat from the exhaust can be trapped using heat exchanger and fed as input to a Stirling engine which in turn produces the mechanical output. This mechanical out is used for running the alternator so the load on engine by alternator is completely eliminated which ultimately enhances the output of the engine. The result will be more appreciable in case of multi cylinder engines rather than single cylinder engines. The above mentioned concept was applied on a 4 stroke BAJAJ platina engine and experiments were conducted. The calculations given below are for a particular engine based on the observed values.

Bore volume – 99cc

Output power – 8.2 bhp at 7500 rpm

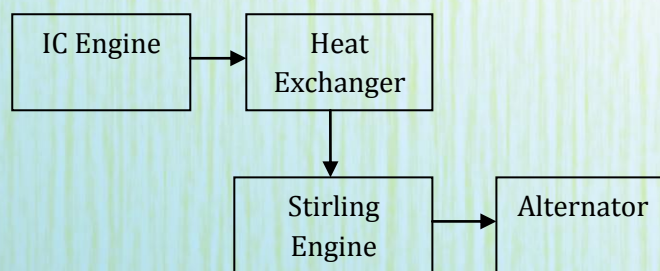
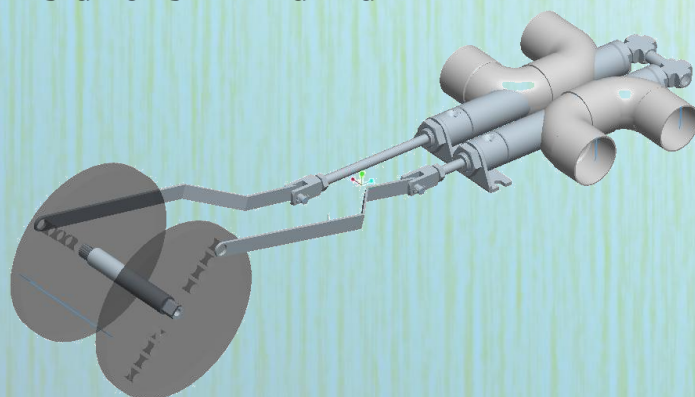
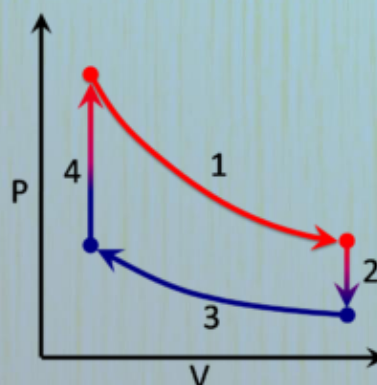


Figure 1: Working Principle

## DESIGN OF STIRLING ENGINE



## STIRLING CYCLCLE



1 – Isothermal expansion





- 2 – Isochoric heat removal
- 3 – Isothermal compression
- 4 – Isochoric heat addition

### THEORITICAL CALCULATIONS

The mass of exhaust gas leaving the combustion chamber can be calculated using the displacement volume.

The displacement volume = 100cc (approx.)

Let us consider the density (D) of exhaust gas is equal to atmospheric air.

$$D=1\text{kg/m}^3$$

Let us consider the engine is running at a normal speed of 3000 rpm.

$$N= 3000/60 \text{ rps}=50\text{rps}$$

Since it is 4stroke engine,

$$\text{No of exhaust strokes in 1 sec} = 25$$

$$\begin{aligned}\text{Volume of exhaust discharged/sec} &= 25 \times 100 \\ &= 2500 \text{ cc/sec} \\ &= 0.025 \text{ m}^3/\text{sec}\end{aligned}$$

$$\text{Mass} = D \times V = 1\text{kg/m}^3 \times 0.025 \text{ m}^3/\text{sec}$$

**So mass flow rate through the exhaust manifold is  $0.025\text{m}^3/\text{sec}$ .**

### HEAT REJECTED FROM EXHAUST

Temperature of the exhaust gases rated speed (7500 rpm)  $200^\circ\text{C}$  (approx.) Let us assume that at nominal speed of 3500rpm the temperature of the exhaust gases might be up to  $120^\circ\text{C}$  (approx.) as the speed of the engine increases the heat lost in exhaust increases. Theoretically speaking the heat rejected

$$= c_p \times \text{difference in temperature.}$$

Mean specific heat of exhaust heat =  $1.0 \text{ kJ/KgK}$

$$\text{Exhaust temp} = 120^\circ\text{C}$$

$$\text{Atmospheric temp} = 30^\circ\text{C}$$

$$\text{Mass} = 0.025 \text{ m}^3/\text{sec}$$

$$\text{Heat rejected} = C_p \text{exhaust} (120-30)$$

**Heat rejected =  $90\text{kJ/Kg}$  of exhaust gas**

**Power produced from this heat =  $2.25 \text{ kW}$**

### OVERALL EFFICIENCY

$$\begin{aligned}\text{Overall efficiency} &= (0.34/2.25) \times 100 \\ &= 15.11\% \text{ (approx.)}\end{aligned}$$

Temperature of the exhaust gases rated speed (7500 rpm)  $200^\circ\text{C}$  (approx.)

$$\text{Heat rejected} = C_p \text{exhaust} \times (200-30)$$

Mean specific heat of exhaust heat=  $1.0 \text{ kJ/KgK}$

**Heat rejected =  $170 \text{ kJ/Kg}$  of exhaust gas (approx.)**

Heat given to the heat exchanger = heat rejected in exhaust

Efficiency of the heat exchanger =  $85\%$  (approx.)

So the heat input to the Stirling engine is = heat transferred from heat exchanger =  $170 \times (85/100)$

Heat input to Stirling engine =  $144.5 \text{ kJ/kg}$  of exhaust gas

Efficiency of Stirling engine =  $40\%$  (approx.)

**So the workout produced =  $57.8 \text{ watts}$**

### POWER REQUIRED BY AN ALTERNATOR (including losses)

Small engines require  $1.75\text{hp}$  to run the alternator for charging the battery.

$$= 1305.5 \text{ W}$$

$$= 1.3 \text{ kW}$$

So a Stirling engine should be designed for the maximum capacity of  $5\text{kW}$  and an average capacity of  $3\text{kW}$  to ensure the proper charging of battery.

### INCREASE IN EFFICIENCY

- Output of the engine without THERMO CONVERTOR =  $8.2 \text{ bhp}$  at  $7500 \text{ rpm}$
- Output of the engine with THERMO CONVERTOR
  - $= (8.2 \times 746) + 57.8$
  - $= 6175 \text{ watts at } 7500 \text{ rpm}$
  - $= 8.2775 \text{ bhp at } 7500 \text{ rpm}$
- increase in bhp =  $8.2775 - 8.2000$
- $= 0.0775 \text{ bhp}$
- increase in power =  $0.0775 \times 746$
- $= 57.18 \text{ watt}$
- efficiency of the engine without thermo convertor =  $14.2260\%$
- efficiency of the engine with thermo convertor =  $14.3605\%$
- **increase in efficiency due to usage of thermo convertor**







$$\begin{aligned} &= 14.3605 - 14.226 \\ &= 0.13\% \end{aligned}$$

## TESTING AND CONCLUSION

The engine was tested for the exhaust temperature at rated speed (3000 rpm). The maximum temperature of exhaust gas is determined. The heat exchanger is tested at its maximum temperature limits. The Stirling engine is also tested for its maximum temperature limits.

From the above tests the actual efficiency are determined and compared with the theoretical values. From the above calculations we conclude that the efficiency of an IC engine increases when **THERMO CONVERTOR** is used. The increase in value is appreciable in case of multi-cylinder engines.

### DID YOU KNOW?

If you scuffed your feet long enough without touching anything, you would build up so many electrons that your finger would explode! But this is nothing to worry about unless you have carpeting! The electrons travel through your bloodstream and collect in your finger, where they form a spark that leaps to your friend's filling, then travels down to his feet and back into the carpet, thus completing the circuit!



## TRAINING HIGHLIGHTS

- ✓ Excellent placements
- ✓ Unlimited practical
- ✓ Individual focus
- ✓ Hands-on practical training
- ✓ Real time projects
- ✓ Industrial faculties
- ✓ Onsite Industrial training
- ✓ Control panel wiring
- ✓ Fully equipped advanced lab
- ✓ Case studies for various processes
- ✓ Free accommodation





# WAKE REDUCTION USING VORTEX GENERATORS AS PASSIVE FLOW DEVICES

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## INTRODUCTION

The constant need for better fuel economy, greater vehicle performance, and reduction in wind noise level and improved road holding and stability for a vehicle on the move has prompted vehicle manufacturers to investigate the nature of air resistance or drag for different body shapes under various operating conditions. Aerodynamic drag is usually insignificant at low vehicle speed but the magnitude of air resistance becomes considerable with rising speed. A vehicle with high drag resistance tends only marginally to hinder its acceleration but it does inhibit its maximum speed and increase the fuel consumption with increasing speed.

## CFD SIMULATION ON THE WAKE OF A CAR MODEL

Computational fluid dynamics, usually abbreviated as CFD, is a branch of fluid mechanics that uses numerical methods and algorithms to solve and analyze problems that involve fluid flows. Computers are used to perform the calculations required to simulate the interaction of fluid with surfaces defined by boundary conditions.

## WAKE REDUCTION USING VORTEX GENERATORS

### Flow control methods

The ability to manipulate a flow field to improve efficiency or performance is of immense technological importance. The potential benefits of flow control include improved performance and manoeuvrability, affordability, increased range and payload, and environmental compliance. The intent of flow control may be to delay/advance transition, to

suppress/enhance turbulence, or to prevent or promote separation. The resulting benefits include drag reduction, lift enhancement, mixing augmentation, heat transfer enhancement, and flow-induced noise suppression.

### Classification of Flow control methods

Classification of flow control methods is based on energy expenditure and the control loop involved. Flow control involves passive or active devices that have a beneficial change on the flow field. A considerable amount of research has been performed using passive methods of flow control, which modify a flow without external energy expenditure.

In cases in which the control must interact with a specific set of turbulent fluctuations already present in the flow, such as random coherent structures, the effectiveness of an open-loop system is reduced.

### Passive Device flow control method

Passive techniques include geometric shaping to manipulate the pressure gradient, the use of fixed mechanical vortex generators for separation control, and placement of longitudinal grooves or riblets on a surface to reduce drag.

### Vortex Generator as Passive control device

A vortex generator is an aerodynamic surface, consisting of a small vane or bump that creates a vortex. Vortex generators are likely to be found on the external surfaces of







vehicles where flow separation is a potential problem because vortex generators delay flow separation. They are typically rectangular or triangular, about 80% as tall as the boundary layer. Since the flow angles and the air foil thickness are better behaved on the outer part, VGs are generally not used here since they besides from suppressing separation, also yield an increased drag. These devices are sometimes a part of the blade design, but are also used to change unexpected flow separation on already manufactured clean blades. Vortex Generators have many geometrical parameters like general shape, height, length and angle to the main flow direction. Further, it is necessary to specify the chord wise position and span wise spacing on the blade.

### Wake reduction by Passive device (Vortex Generators)

A vortex generator creates a tip vortex which draws energetic, rapidly-moving air from outside the slow-moving boundary layer into contact with the aircraft skin. The boundary layer normally thickens as it moves along the aircraft surface, reducing the effectiveness of trailing-edge control surfaces;

vortex generators can be used to remedy this problem, among others, by re-energizing the boundary layer. Vortex generators delay flow separation and aerodynamic stalling; they improve the effectiveness of control surfaces and, for swept-wing transonic designs; they alleviate potential shock-stall problems. Vortex generators are series of small winglets that are glued on to the blade shortly upstream of the separated region. By creating longitudinal vortices, they mix high momentum free stream air into the bottom of the boundary layer, thus delaying separation. By delaying the boundary layer separation, the wake that is present behind the vehicle gets reduced and thus the fuel efficiency is increased.

### CONCLUSION

The passive flow control method is chosen to minimize the wake region behind the vehicle. Vortex generator is chosen as passive device which creates vortices, where the laminar flow gets converted into turbulent flow and so the boundary layer separation gets delayed. Due to this the wake region behind the vehicle minimized i.e., the low pressure region behind the vehicle gets reduced.

### TRIVIA

- ✓ *The word Engineer comes from the Latin word meaning 'cleverness'.*
- ✓ *The temperature in Fahrenheit can be determined by counting the number of cricket chirps in 14 seconds and adding 40.*
- ✓ *The effect of Relativity made astronaut Sergei Avdeyev a fraction of a second younger upon his return to Earth after 747 days in space.*
- ✓ *People say "Bless you" when you sneeze because when you sneeze, your heart stops for a millisecond*
- ✓ *The cigarette lighter was invented before the match*
- ✓ *Like fingerprints, everyone's tongue print is different*
- ✓ *Wearing headphones for just an hour will increase the bacteria in your ear by 700 times.*





# EEG BASED ACQUISITION DEVICE FOR A BRAIN ACTUATED BIONIC ARM

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## INTRODUCTION

Robots have become important in a wide range of applications, one of which is a robotic arm. The recent emergence of successfully performing Brain-Computer Interfaces (BCI), has given a new hope for the disabled and elderly population for improvements in quality of life. The present BCI creates a very strong symbiotic relationship between humans and machines.

## HOW DOES A BRAIN GENERATE A SIGNAL?

Neurons communicate through an electro-chemical process. When a signal reaches a synapse, it triggers the release of neuro-transmitters, which are small molecules that diffuse in inter cellular space, and this activates the receptors on other synapses. In turn, the activated receptor generates electrical signals of variable intensities. The signal coming from every synapse of a neuron passively converges to the base of its axon and then they are summed up. Therefore, the neurons use electricity to communicate with each other. Thus, millions of electrons sending signals at the same time produce an enormous amount of electrical activity in the brain, commonly known as the brain wave pattern because of its cyclic wave nature.

## PRINCIPLE OF BCI

A BCI has four components- a signal capture system, a signal processing system, a pattern recognition system, a device control system. The signal capture system makes use of scalp electrodes, together with a sticky gel, to obtain signal which passes through a unity gain amplifier to boost its level for process. Using Fast Fourier transform algorithms, it is converted into a discrete signal. A digital signal processing software is used for proper sequence generation, after which its output is

fed to a pattern recognition system to select the proper system. These brain waves are generated due to the differences in electrical properties carried by ions on membrane of each neuron.

## PLACEMENT OF ELECTRODES IN THE SIGNAL CAPTURING SYSTEM

For placement of electrodes, the 10-20 system is used, which describes the exact location of the scalp electrodes. EEG technique uses an electrode cap that is placed on the user's scalp for the acquisition of the EEG signal, which relates the scalp potential differences to various complex actions. Classification of the EEG signal has been made into several bands like alpha, beta, delta, theta and mu suppression, each corresponding to various states of 'being' like relaxing, ranging over 8-14 Hz; concentrating, ranging over 13-30 Hz; deep sleep, from 0-4 Hz; meditating from 4-8 Hz; moving your hands or legs or just by imagining these motor actions respectively.

## DATA ACQUISITION

The article presents how to control a cursor in 2D using EEG based brain computer interface. The movements of the cursor on the computer screen are controlled based on the EEG scalp potentials. The EEG signal is mapped from the user head to the 2D cursor control. The horizontal motion is based on the mu beta rhythm and vertical motion is based on P300 potential respectively. The user can move the cursor horizontally to the right or left just by imagining his right or left hand motion and he can move the cursor vertically upwards or downwards by focusing on the UP button or DOWN button on the monitor respectively.





## P300-BASED BCI PARADIGM

The paradigm comprises four steering commands, 0UA, encoded by the following symbols: FORWARD, RIGHT, DOWN, LEFT and STOP. These symbols flash randomly with an inter-symbol interval (ISI) of 75 ms, and a flash duration of 100 ms, i.e., the Stimuli Onset Asynchrony (SOA) is 175 ms. Because of the low SNR of P300 ERPs, several P300 responses have to be collected before machine learning algorithms can identify the mentally selected symbol. Therefore, the overall time needed for symbol detection (TT—trial time) depends on the number of event repetitions (Nrep), yielding

$$TT = Nrep \times Ns \times SOA + 1$$

Where Ns is the number of symbols (Ns = 4), and the value 1 is the time required to record the EEG associated with the last event of a trial (e.g., for a user requiring 3 repetitions,  $TT = 4 \times 0.175 \times 3 + 1 = 3.1$  s). The number of repetitions is adjusted for each participant according to his/her offline accuracy, obtained during the BCI calibration.

## EEG SIGNAL ACQUISITION

This stage targets the careful extraction of the EEG signal from the user scalp. It is made up of different components such as instrumentation amplifier, operational amplifier, high pass, low pass and notch filters. The EEG signal extracted by the instrumentation amplifier is passed through the high pass, low pass and notch filters after amplification by Op-Amp. Integration of a notch filter will filter out undesirable power line signal. The high pass filter, removes the noise in the signal and low pass filter extracts the signal frequencies of interest.

## SIGNAL TRANSMISSION

This stage focuses on the transmission of the acquired EEG signal to a PC. EEG signal is digitized by 12-bit A/D converted and then transmitted to a PC through Opto-coupler for electrical isolation.

## SIGNAL PROCESSING

In this stage, the EEG signal gets processed in the MATLAB and is used for controlling a 2D cursor on the GUI. The simulation of the EEG amplifier can be done using Multisim Simulation tool. The EEG amplifier consists of an instrumentation amplifier, operational amplifier and a voltage follower with a virtual ground set up. Two First Order high pass filters are integrated; one each after instrumentation amplifier and operational amplifier. A first order low pass filter is integrated along with the operational amplifier. A high pass filter is coupled in between pre and post amplification stages and another is coupled after post amplification stage. Each of these high pass filters prevents the low frequency noise being carried to the later stage. A low pass filter is integrated along with the OP-AMP to extract the frequencies of interest.

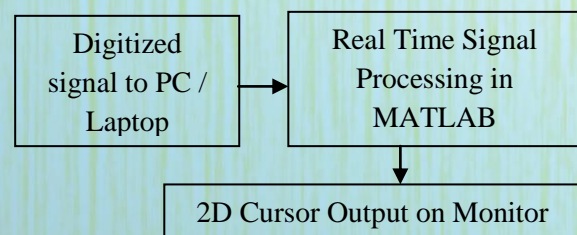


Figure 1: Signal Processing

## REAL TIME ARM MOVEMENT

Basically, the movement of the cursor must be converted into a kinetic movement in order to realize the functioning of the bionic arm. This is made possible by detecting the change in the position of the cursor for every infinitesimal or very short period of time and the angle at which the position changes. This data is stored in memory. The open Framework, an open source tool kit is used to code and control the movement of the bionic arm using the data stored in memory about the positional change of the cursor. Thus, a real time movement of the bionic arm is made possible.

## CONCLUSION

Thus, this versatile bionic arm, which operates on BCI, can pick any object like human fingers. Thus, non-invasive EEG serves as a convenient and safe recording method that is ideal to bring brain-machine interface (BMI) technology to a large population.





## MUFFLER AND RESONATOR OPTIMIZATION

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### INTRODUCTION

The key objective in designing a vehicle is “Cleaner, Quieter and Safer driving of the vehicle”. The other important areas of focus include emission regulation, NVH (Noise Vibration Harshness) regulation and durability of the vehicle. The main sources of noise in a vehicle are the exhaust noise and the noise produced due to friction of various parts of the engine. In an automotive engine, pressure waves are generated when the exhaust valve repeatedly opens and lets high-pressure gas into the exhaust system. These pressure pulses are the sound we hear. As the engine rpm increases, so do the pressure fluctuations and therefore the sound emitted is of a higher frequency. To reduce this noise, various kinds of muffler and resonator combinations are used. Muffler is a sound attenuating device, which also has a role in engine performance.

### EQUIPMENT SETUP IN LMS TEST

The components of the LMS test are

- LMS SCADAS MOBILE (Data Acquisition System)
- ACOUSTIC DRIVER (Speaker)
- IMPEDANCE TUBE
- MICROPHONE

#### 1. LMS Scadas mobile

SCADAS MOBILE is an input module supporting full voltage, ICP signal conditioning and signal processing for four channels. The v4-II offers ultralow power consumption with a high performance 24 bit analog to digital converter. A human-machine interface or HMI is the apparatus which presents process data to a human operator, and through this, the human operator monitors and

controls the process. A supervisory (computer) system gathers data on the process and sends commands (control) to the process. The main features and benefits are its 4 input channels via BNC connectors, Smart sensor support, and 24-bit analog to digital conversion with 46 kHz Bandwidth.

#### 2. Acoustic driver

The high quality JBL acoustic driver is capable of producing continuous high sound level inside the tube assuring high signal to noise ratio by design.

#### 3. Impedance tube

The impedance tube is used to determine the complex acoustical impedance of sound incident normally on it and the absorption co-efficient of a material each as a function of frequency.

#### 4. Microphone

A microphone is an acoustic-to-electric transducer or sensor that converts sound into an electrical signal. The solution for sound transmission loss using impedance tube is based on the four microphone transfer matrix method. For transmission loss testing, four microphones of sizes  $\frac{1}{4}$ ,  $\frac{1}{2}$ ” are required.

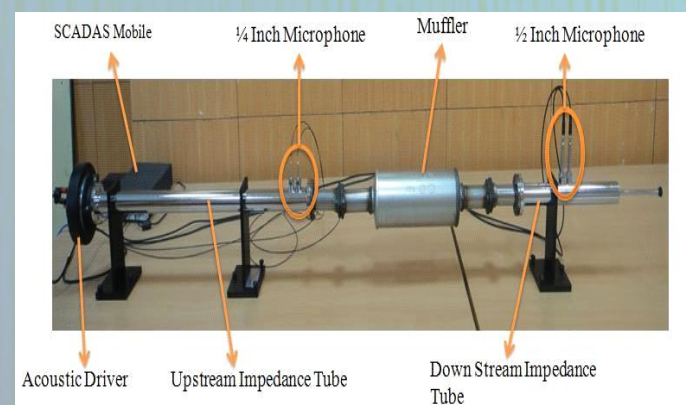


Fig1. LMS setup



## DESIGN METHODOLOGY

Traditional design method

- Cut and try method

Acoustic prediction method

- Time domain prediction
- Frequency domain prediction

## BASIC DESIGN

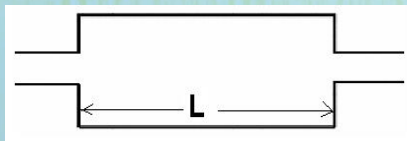


Fig. 2 Single expansion chamber

## INTAKE RESONATOR DESIGN

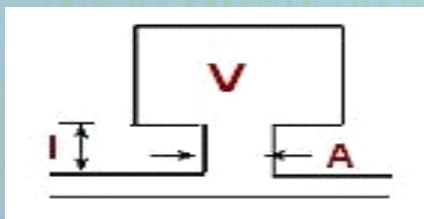


Fig. 3 Intake resonator

It has a cavity of volume  $V$  connected to a duct through a connecting cylinder of diameter  $d$ . As a periodic sound wave propagates down the duct, the mass of gas in the cylinder is forced in and out of the cavity. The gas in the cavity acts like a spring as it is alternately compressed and expanded due to the motion of gas in the connecting cylinder. It causes a loss of momentum and finally the sound gets decreased. It is designed to reduce the sound for a particular frequency.

## EXPERIMENTAL METHODOLOGY

### Modified Muffler

The Components of modified systems are Base plate, V plate and Baffle plate.

### Base Plate

Base plate is used for holding the V plates and to provide reflection of sound waves. It has 235 perforations below which the

glass wool is placed for absorbing sound waves, thus attenuating it.

### V Plate

The V plates which are placed over the base plate provide deflection of sound waves, such that low and high pressure sound waves cancel each other. It is placed in such a way that it has top and side clearance, such that there will not be any back pressure.

### Baffle Plate

The circular baffle plate having 157 perforations is used in cancellation of sound waves. It reduces the velocity of the exhaust gas by obstructing the flow and by attenuating noise.

## RESULT AND DISCUSSION

The Transmission Loss (TL) of the Etios Main Resonator was found to be good at higher frequency, but left much to be desired at lower frequencies. The TL of the Helmholtz Resonator is able to meet the noise target level between the frequency range 23 Hz to 31 Hz and 75 Hz to 88 Hz. The modified Etios Main Resonator with a series of V Plates at the entry of exhaust gas has the ability to increase the Transmission loss at lower frequencies.

The selected system uses main resonator and Helmholtz resonator combination to meet the noise target level at lower frequencies, but the modified main resonator has a TL better than the existing system at lower frequencies and was not able to meet the TL for the rest of frequency of the existing system though it achieves the noise target level.

## CONCLUSION

A modified system with series of V Plates at 40% of the length of the main Resonator at the entry of exhaust gas was built and the conclusions that were made are as follows:

1. The Etios Muffler can be used where low frequency operation takes place.
2. The modified system also has the ability to attenuate noise above the frequency range of 4500 Hz.
3. It can also perform the function of Helmholtz Resonator by attenuating noise at a particular frequency.





# AUTOMATED BLOOD DELIVERY SYSTEM

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## INTRODUCTION

Medical emergencies in hospitals are taken care of today with sophisticated technology and intelligent research. However, the delay in transportation of blood packets or drugs from the inventory unit to the operating room is a serious concern to all health centers. This delay could prove fatal if not done efficiently. Recent technology development provides a solution to this problem but is not feasible in developing countries. The use of intelligent agent based delivery is the heart of this proposal.

## A MONORAIL AND ROBOT MECHANISM

To avoid the complexity of transporting articles of non-emergency, this specifically designed robot can serve to transfer blood and drugs from the inventory unit to the operating room only. Using an efficient GPS tracking and bar-coding technique this model could become a cheap and feasible solution to problems faced by most hospitals all over the world.

## DESIGN AND SPECIFICATIONS

The design comprises of a monorail track, a few centimeters above the floor which runs only from the inventory unit to the operating room or an intensive care room. The monorail preferably runs along one side of every available path. A mini robot with inbuilt sensors for path detection, tracking and with a wireless data transceiver is mounted on the monorail stand. The robot is provided with a container on the above with a capacity of necessary size. The container is provided with a safety latch to be protected from external environment. The robot is powered by a high speed electrical motor. A timer unit is inbuilt to calculate time delay.

## CONCEPT OF DELIVERY

Every operating room or intensive care

unit (destination unit) is provided with a button which generates a unique signal to the robot. In case of emergency, a phone call is made to the inventory unit (start unit) to specify the materials provided and also the unique signal is raised.

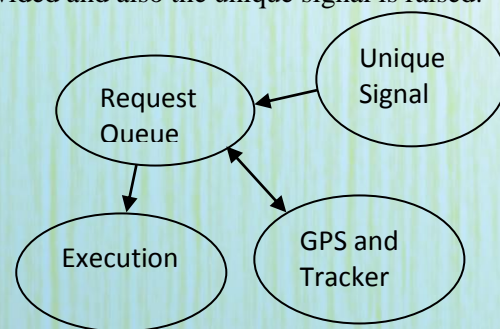


Fig1: Visual Layout of delivery mechanism

The signal acts a selection algorithm to go to the necessary destination. When a particular operating room raises the signal the following process occurs,

- A timestamp is stored in the memory queue of the robot.
- If there is no waiting timestamp from a previous request, the robot goes to the inventory unit and waits for loading. Once loaded, a button available on robot is pressed to indicate completion of loading.
- Now the robot moves to required destination by the nature of signal initially requested in the operating room, through a network-based intelligence and delivers the components. Again a button is pressed to indicate completion of unloading.

To handle multiple requests simultaneously the basic process is discussed below,

- If a request occurs during delivery of a previous request: using the GPS, the distance to inventory unit and operating room is compared.





- If operating room is closer, the previous request is completed first and then the present request is attended to.
- If the inventory unit is closer, the robot goes back to start position to load the latest request and delivers both the packages based on the timestamp queue recorded i.e. earlier timestamp request is delivered first.

In a multi-request (say 2-request process) handling mechanism, the commonly used methods are,

```
void isStartUnit()
{
    error()
    if(location=start unit)
        return
    else
    {
        Go to start unit //delay
        return(isStartUnit ())
    }
}

void checkButtonPress()
{
    error ()
    if(button press?) return
    else
    {
        //delay
        return(buttonPress ())
    }
}

void error()
{
    if (waiting time of request 1 > max time
    allowed || waiting time of request 2 if
    any > max time allowed )
    {
        //Report error of request
        exit ()
    }
}

int checkRequest()
{
    return(checkPossibility())
}

int checkPossibility()
{
    if (destination distance > distance to start
```

```
unit || waiting time > max waiting time)
    return 0
else
    return 1
}

reload()
{
    isStartUnit ()
    checkButtonPress ()
}

}
```

The overall Pseudo code which handles a 2-request process is,

1. Get timestamp if signal arises  
While (timestamp queue! =NULL)  
{  
if (queue update at any instant  
through interrupt &&  
checkPossilbity() )  
{  
//Continue previously  
//ongoing process  
}  
else  
{  
reload ()  
error ()  
checkButtonPress ()  
error ()  
checkButtonPress ()  
//Go to start unit  
//Repeat step 1  
}  
isStartUnit ()  
checkButtonPress()  
//Move along preset path and go  
//to destination unit  
error()  
checkButtonPress ()  
//Return to start unit  
}  
2. Repeat step 1  
3. End

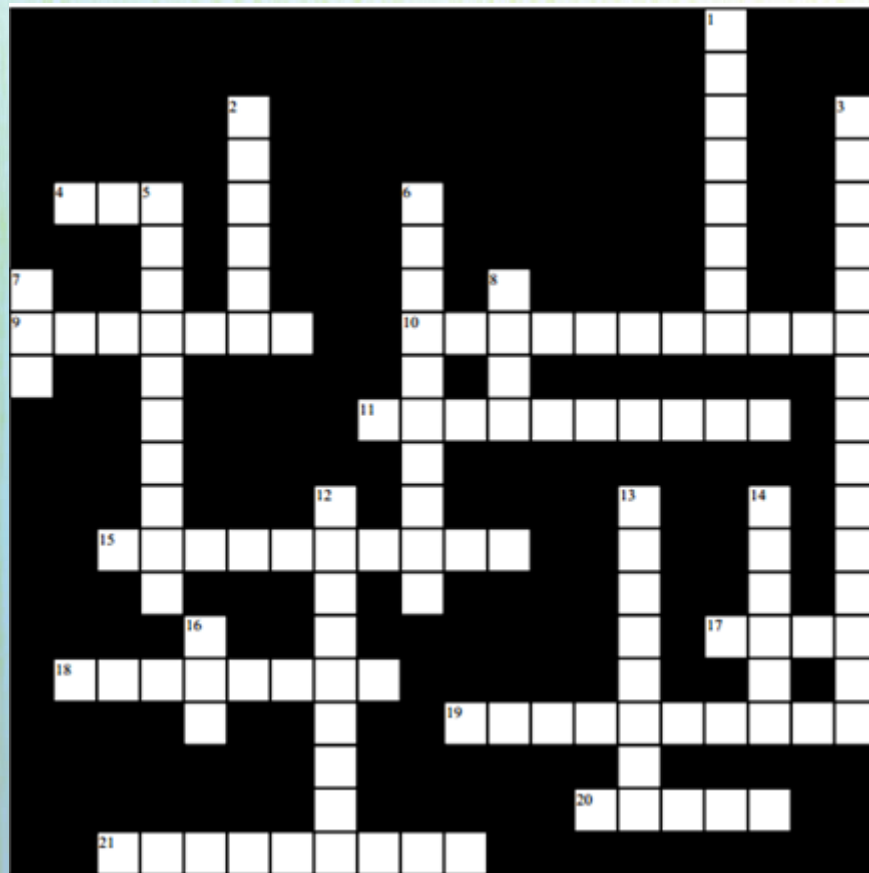
## CONCLUSION

A cost-efficient delivery system is the need of the hour in most developing countries. Such effective mechanisms help in speedy delivery of immediate resources thereby immensely reducing fatal losses due to delay.





### TECHNICAL CROSSWORD



#### Across

4. An important measure especially in communication.
9. An input which is generally a disturbance.
10. The most widespread example of galvanic isolation.
11. It is actually a resistor, a transfer resistor!
15. The process of varying one or more properties of a periodic waveform.
17. 3-15psi to 4-20ma.
18. The basis of automation.
19. Torque proportional to square of current in this instrument.
20. 1,650,763.73 wavelengths of light from a specified transition in Krypton-86.
21. A signal to the processor emitted by hardware or software indicating an event that needs immediate attention.

#### Down

1. A type of motor for moving or controlling a mechanism or system.
2. A unit of viscosity.
3. I sometimes do this to get the slope.
5. This is exactly what you would need for constant voltage.
6. The phenomenon in which the value of a physical property lags behind changes in the effect causing it.
7. A typical control algorithm.
8. A very important parameter of a controller.
12. The electrical equivalent of spring.
13. A reaction to something.
14. What do you do when there is a noise in your signal?
16. Also called as half power point.





# EQUALIZED POWER REGULATION AMONG HOUSEHOLDS USING REAL TIME CLOCK BASED INTELLIGENT METERING SYSTEM

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## INTRODUCTION

One of the major concerns for every one is the fast depleting natural resources. High power needs at cities which has less power cuts than other areas. For the sake of our power starved industries, to save our economy, we must evenly distribute power rather following the present system.

## EXISTING SYSTEMS

Presently we have the power from the substations and master metering system. The methods we have been using now are Electronic energy meter with remote monitoring and prepaid billing system, measuring energy meter of three-phase electricity, planning optimal intelligent metering for distribution system monitoring and control. They have the following drawbacks:

- Unequal power distribution to host
- Mismatching of power loads and usage of power.
- Current tripping and thefts.
- Master metering system-dividing unequal power to the rural and urban industries.
- Voltage and current fluctuation due to higher load values.

## NEED FOR REGULATION

Once there was a time where the power generated is sub utilized by maintenance, and also it was equally distributed without the need for the regulation criteria. But now due to increase in consumption and load changes, the regulations were done only at substation level and not to host.

## DESIGN OF THE SYSTEM

The system consists of:

### A. Circuit breaker:

When the usage has gone beyond the set point values, circuit breakers are necessary to cut off the power once it gets the output from the comparator.

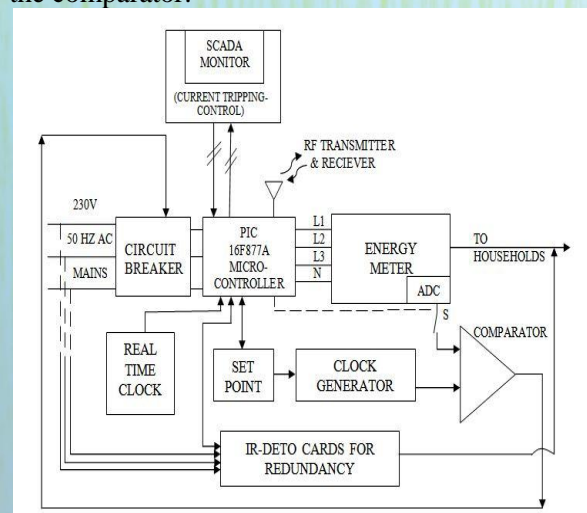


Figure 1: System design

### B. Comparator:

Using Digital comparator, we can generate outputs even if the given binary inputs from energy meter and clock generator are equal or one greater than or less than the other where energy meter measures the amount of electrical energy supplied and clock generator generates the time signal.

### C. PIC 16F877A micro-controller:

The PIC 16F877A is a powerful (200 nanosecond instruction execution) yet easy-to-program (only 35 single word instructions) CMOS FLASH-based 8-bit microcontroller packs Microchip's powerful PIC architecture into a 40- or 44-pin package. Having a self





programming feature it uses 8 channels of 10-bit (A/D) converter for input output and a Universal Asynchronous Receiver Transmitter (USART) for RF data transmission & reception.

#### D. Scada Monitor:

Supervisory control through data acquisition (SCADA) which is more secure and effective, is the automated way of detecting the mal usage of the energy.

#### E. Ir-deto cards for redundancy:

Ir-deto cards can be used as redundancy system in cases of power shortage during emergencies.

### WORKING

The power supply distribution based on Prioritization ensures equal power sharing among the people.

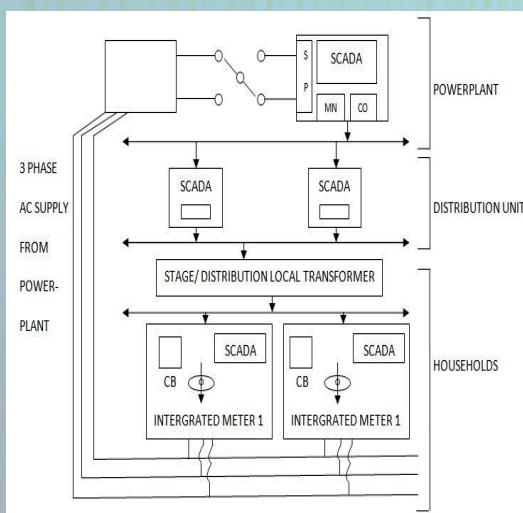


Figure 2: Working

#### A. Regulating System:

Initially, the power which comes to the home is made to pass through a system which consists of regulating and monitoring circuits. The circuit breaker is responsible for cutting and resuming the power supply based on the input it receives from the comparator. The meter records the power that is used by the house hold per day. The value of power consumed is converted into a digital signal and

is given to the comparator which compares the ideal power consumption and actual power consumed and accordingly sends interrupts to the Circuit breaker, which cuts off the power supply or maintains. The supply here can be revived by prepaying for the amount of power using IR-DETO cards and this gives a redundancy path for the passage of electricity. PIC microcontroller monitors and interfaces all the components to the system. It is embedded inside the circuit breaker itself. The real time clock placed basically acquaints the controller with the details of duration of a day's time that is when to gather the distribution analysis of the day and all. So the set point is set accordingly by using the micro controller and this generates clock pulses of definite duration throughout the day.

#### A. TrippingControl and Monitoring Systems:

The existing system was an inefficient system as we need to intervene manually and check by breaking the circuit and also becomes an easy to go system for all mal practices. To overcome this we have SCADA power systems which analyses the power usage using a priority dial and the supervisory ratio that finds a change in power factor whenever there is a mal function or current larceny. Power factor relation [4] with the current is given by

$$\text{Power Factor } (\cos \phi) \propto 1 / I(V)$$

where, V is the voltage constant.

The decreased value of the power factor clearly states that there is an imperfection in the value of the meter readings which means we are paying the bill of the electricity someone else has consumed.

### CONCLUSION

We consider this hybrid mode, which uses intelligent power metering system in social and large scale aspects in spite of its disadvantages. It aims at saving power at large and hence enabling better usage of power. Thus, by the calculation, one can conclude that this concept of prioritization would yield fruitful results and helps to save power at large as mentioned before.





## BLOOM BOX

**S. SHIV SHANKAR**

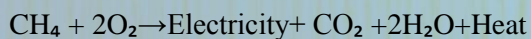
*II year, Electronics and Instrumentation.  
Madras Institute of Technology*

### INTRODUCTION

A fuel cell is a voltaic cell which converts the chemical energy of fuel directly into electricity without combustion. When a large number of fuel cells are connected in series, it forms a battery. The recent and the most significant development in the field of fuel cell is "Bloom Box".

### DEVELOPMENT OF BLOOM BOX

Dr. K.R.Sridhar, an engineering graduate from Trichy, developed Bloom Box, which uses natural gas as fuel to develop electricity. When he was working in NASA, he did a research to obtain oxygen by supplying electricity. This research was to check whether favourable conditions are there in Mars for living. But, unfortunately his research work was scrapped by NASA. He then reversed his idea. When oxygen was supplied along with fuel, he obtained electricity! The basic formula is:



### THE BLOOM BOX

For the Bloom Box, external power source is not needed. Sand is baked till it turns into ceramic and it is cut into little squares. Then, the ceramic substance is painted on either side with special green and black inks to get green and black layers.

The anode is made up of Green Nickel Oxide and the cathode is made up of Black Lanthanum Strontium Magnetite. The above combinations form disks which are stacked together separated by cheap metal alloys. It has a wireless router to transmit power wirelessly.

It has the following specifications

- 1 fuel cell ---- 25W (1 disk)
- 1 stack -----1KW (40 disks)
- 1 module-----25KW (25 stacks)
- 1 Server-----100KW (4 modules)

### WORKING

The following picture provides crisp information regarding the functioning of Bloom Box.

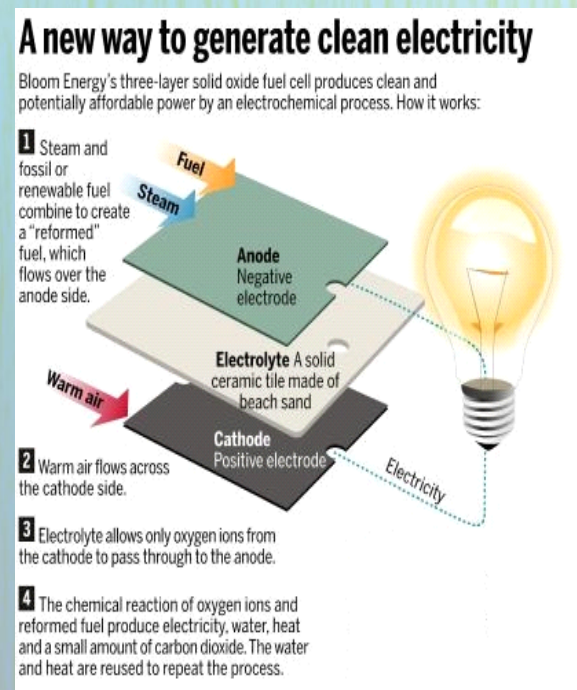


Figure 1: Bloom box

A single disk can power one light bulb. Stack of disks can produce more power. Presently, companies like Netscape, Google, Amazon, and eBay are trying out these boxes. If it succeeds, the Bloom Box may reach the market very sooner.





## ADVANTAGES

- Main objective is to replace the grid and bloom box is cleaner and cheaper than grid.
- Wireless power transfer: Highly efficient since in conventional methods, 40% of electricity is lost during transmission.
- It acts as a continuous source of energy. The fuel is continuously supplied to produce power.
- It can withstand temperatures up to 9800 C.
- It can be used in remote areas where the construction of electric poles and

transmission of electricity is very difficult.

## CONCLUSION

The newest offshoot in the field of electricity is wireless power transmission and Bloom Box is going to become a “trendsetter” in near future. Wire usage, cost, and transmission losses are completely avoided by this technology. As it is rightly said, “Every invention augments the power of man and the well-being of mankind” -no doubt, the world is pacing towards a greener environment.

## FUN FACTS

- *Golf balls have dimples because they help reduce drag; this allows the ball to fly further than a smooth ball would.*
- *The tallest wind turbine in the world has rotor tips that reach over 200 meters (656 feet) above the ground.*
- *A car travelling at 80km/h uses half its fuel to overcome wind resistance.*



## WHAT WE DO

- ✓ Electro mechanical turnkey Projects
- ✓ Control Automation system integration E & I turnkey projects
- ✓ OEM Solutions
- ✓ Information solutions and manufacturing intelligence solutions
- ✓ Customer support
- ✓ Technical resource deployment
- ✓ Products and Standard Solutions





## STRATELLITES

**KESAVAN.G, LOGANATHAN.N.N**

*III YEAR, Electronics and Communication,  
Madras Institute of Technology*

### INTRODUCTION

A "stratellite" is a high-altitude airship (HAA) 25 times larger than the Goodyear blimp employed much like a satellite for remote sensing, navigation, and communications. Instead of being stationed on orbit, stratellites are positioned in the stratosphere approximately 13 miles above the Earth. From this height, stratellites can service a 300,000-square-mile-area. The North American Aerospace Defence Command (NORAD) projects that eleven such airships could provide radar coverage of the entire maritime and southern borders of the United States.

### CONSTRUCTION OF STRATELLITE

The initial Stratellite was 188 feet long, 60 feet wide and 42 feet high. It is provided with a new steering method which uses a hybrid electric system that drives large, slow-turning propellers. This gives the airship helicopter-like agility by being able to move both up and down, and side to side. The outside layer, or "envelope," is made out of a high-tech material called Spectra fabric used in bullet-proof vests and parts of space shuttle.

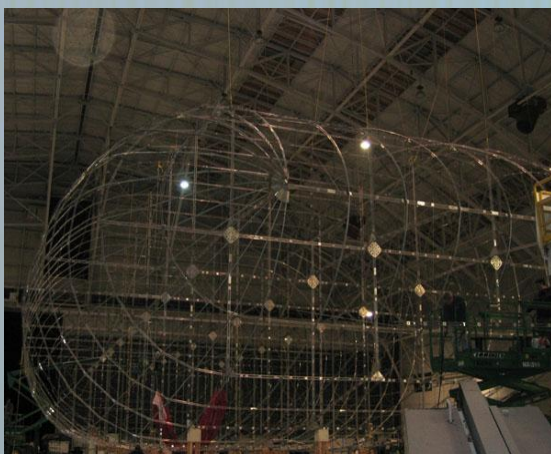


Figure 1: Stratellite

Spectra contain fibre 10 times as strong as steel of the same weight and has the unique feature of being easy to cut but virtually impossible to tear. The inside layer, made from a thin but strong polyester film called Mylar, is fitted inside the envelope and filled with a mixture of helium and air as helium is an inert gas and is therefore not flammable. With this design, the helium expands as the airship rises, forcing air out and lifting the airship. The cycle continues, allowing the airship to gain more and more altitude until the helium has expanded to fill the envelope completely. Because the pressure is so low inside the envelope, a puncture would only result in a very slow leak, taking a long time to totally deflate.

### STRATELLITE TECHNOLOGY AND ADVANTAGES

Stratellites are actually unmanned Kevlar balloons filled with helium. They use thin-film photovoltaic cells sprayed on their surfaces to generate electricity, which drives propellers that work with GPS technology to keep the stratellite positioned over one spot on the Earth's surface. Prototype airships are projected to carry payloads as large as 4,000 pounds, and later models are expected to carry over 20,000 pounds of radars and other remote imaging equipment, navigational aids, and telecommunications relays. Stratellites are planned to remain on station for a year at a time and will cost one fifth as much as a comparable satellite

### DRAWBACK OF STRATELLITES

The first is signal latency, which can cause problems in establishing broadband links. Most telecommunication satellites are in geostationary orbit to remain above a certain point on the Earth's surface. That orbit,





however, is 22,240 miles above the Earth which means that a signal going up to the satellite and back to the Earth travels nearly 45,000 miles, which equates to about a quarter of a second delay. Even users of satellite voice links notice the delay.

The second drawback is that satellites are in space, requiring expensive space launches, an additional level of regulation by national space authorities and an orbital allotments by the International Telecommunication Union (ITU). Satellites remain in national airspace and are therefore not subject to these licensing and technology requirements. However, they do make use of space technology and, as stated above, are in development by at least one space industry firm.

### SERVICES

At an altitude of 13 miles, each Satellite will have clear line-of-sight communications capability to an entire major metropolitan area as well as being able to provide coverage across major rural areas. The Satellite will allow subscribers to easily communicate in 'both directions' using wireless technology. This means that subscribers can send and receive information using the wireless network.

### SATELLITES TELECOMMUNICATION

Satellites offer a window of telecommunications opportunity. Effectively, a Satellite positioned over a major metropolitan area could act as a cell tower thirteen miles high. A Satellite, equipped with the appropriate transponders, could manage the wireless needs of that entire metropolitan area. Transponder access could be leased to broadband users, cell phone companies, TV networks, radio stations, various levels of government, and to corporations with large broadband requirements. These consumers could then resell access to end users. None of this type of business or wireless use is innovative, so

existing regulatory schemes and business models cover Satellite communications. In fact, Satellites employed in this manner would make use of existing spectrum allocations, at least initially, and not require expensive bandwidth acquisition. By increasing the utility and availability of the type of link that has, until now, been restricted to satellites, firms can bring broadband links to new areas, provide for increased usage, and service larger markets without any fundamental change in operations.

### SATELLITE CHALLENGES AND BUSINESS OPPORTUNITIES

Though the opportunities for increasing broadband links and for profit are enormous, Satellites are still in their infancy. They present several problems that have yet to be fully addressed. The public may be concerned about such large, unmanned payloads stationed above metropolitan areas and recent developments in sub-orbital flight could eventually lead to traffic problems in the stratosphere. Once these concerns are overcome and working Satellites are available, the potential exists for vastly expanding broadband links. Sanswire technologies have recognized this marketing opportunity and have formed joint ventures with the space industry and balloon-makers. However, in addition to marketing, Satellites will require ground control and maintenance, and used Satellites will require refurbishment before redeployment, tasks which the manufacturers and marketers may well lack the capacity or desire to perform.

### CONCLUSION

Satellites provide the facilities of wireless communication more efficiently than the ordinary and conventional towers. The Satellite will allow subscribers to easily communicate in 'both directions' using wireless technology. They minimize the cost of communication. They play a vital role in the future generation wireless communication.





# ELECTRONICS AND NANO TECHNOLOGY

**OM SHIVAM**

IV Year, Electrical and Electronics,  
Dr. MGR Educational & research Institute University

## INTRODUCTION

Everyone is looking for the “next big thing” to bring back the economic golden age and Nanotechnology is becoming is apt to rely upon and is certain to have a substantial impact. In just fifteen years nanotechnology industry will be the booming economic force greater than drugs, cosmetics & machine—almost bigger than all of them combined. In electronics sector also Nano technology has a greater impact in forms of PV cells, LEDs, insulating materials and much more. Nano technology has given a space to use technology efficiently and effectively.

## CARBON NANOTUBE TRANSISTORS

Carbon Nanotube field effect transistors (CNFETs) are a new gift by Nano technology in field of electronics. CNFETS have been used recently to build a GHz amplifier. CNFETs are very attractive for RF applications such as amplifiers, mixers and switches. Carbon nanotubes and grapheme materials have superior electrical, mechanical & thermal strength and extremely strong carbon-carbon bond leading to large mean free paths, high current densities and low thermal noise. Ballistic transport of electrons through semiconducting carbon nanotubes has led to the development of CNFETs one of the key building blocks of any electronic application. The one dimensional tube structure allows quantum-capacitance limited operation, resulting in low input and feedback capacitance.

## ADVANTAGES OVER CONVENTIONAL SEMICONDUCTORS

It also significantly reduces the scattering probability, thus promising high frequency performance with low figures. The

structure also causes the drain current to be linearly dependent on the applied gate voltage, promising uniquely linear devices. CNFETs are thermally robust, which simplifies the heat management. The current conventional semiconductor devices used in RF front-ends can be designed with high linearity but at the expense of reducing the operating efficiency to about 5%. CNFETs which are recently developed, deliver similar linearity but at 70% less dissipated power. The system has deep impact on battery life and reduction in heat dissipation.

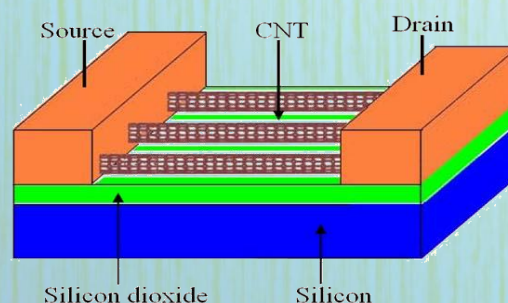


Figure 1: CNFET

## CONSTRUCTION OF THE DEVICE

In a CNFET, thousands of nanotubes are laid out between the drain and the source, providing a low resistance channel. The current flow through the channel is controlled by a top gate, separated from the tube array by a high-K dielectric. The base substrate is

Silicon, which serves as the mechanical platform. A thick SiO<sub>2</sub> is grown over it to minimize the device parasitic for high performance operation. On this layer, a suitable catalyst is deposited to enhance growth and directionality. Then the carbon nanotubes are grown in a CVD furnace. Source, drain fingers and pads are then defined by the use of standard photolithography. Then a gate oxide is grown, on top of which the





gate is patterned. The most desirable future work involved in CNTFETs will be the transistor with higher reliability, cheap production cost, or the one with more enhanced performances.

### CONCLUSION

Researchers are investigating to find out much better and efficient electronic

devices with the help of Nano technology. Nanotechnology is built on defensible intellectual property that can be patented but difficult to replicate. It opens the horizons in reduction in size of the component without compromising the efficiency of the component. The scope of nanotechnology is very wide; we only have to identify our sector and horizon of tomorrow.

## TECHNICAL CROSSWORD ANSWERS

### Across

- 4. SNR
- 9. Impulse
- 10. Transformer
- 11. Transistor
- 15. Modulation
- 17. P to I
- 18. Feedback
- 19. Moving iron
- 20. Metre
- 21. Interrupt

### Down

- 1. Actuator
- 2. Stokes
- 3. Differentiation
- 5. Regulation
- 6. Hysteresis
- 7. PID
- 8. Gain
- 12. Capacitor
- 13. Response
- 14. Filter
- 16. 3dB





## HIGH PRESSURE SCIENCE

**V. SOUNDARYA, M. ASWINIDEVI**

*III year, Electronics and Instrumentation  
Madras Institute of Technology*

### INTRODUCTION

High pressure science evolved when scientists found that the hydrogen atoms exist in liquid state in the earth core due to high pressure, approximately billion pounds per square inch. It ended up with the scientists generating high pressure experimentally in order to explore permutations of matter that do not exist in most of the universe, based on the fact that when substances are compressed between two diamonds, they achieve a sort of alchemy.

### TECHNIQUES TO ACHEIVE HIGH PRESSURE

**Diamond Anvil cell** - The Diamond anvil cells (DAC) are devices that allow reaching extreme pressures. It is relatively easy to reach pressure in the order of the megabar using a DAC. The Diamond is the hardest material however, it is also very brittle. Therefore, it is necessary to handle them with great care in order to prevent breaking them.

**Multi Anvil** – This type is a relatively rare research tool. It is capable of producing extremely large pressures

**Shocks** - These extraordinarily high pressures, created experimentally by the gas gun, occur during explosions, the detonation of nuclear weapons, in inertial fusion experiments, or when a large meteorite hits Earth.

### PRODUCING HIGH PRESSURE

With the diamond anvils at the Carnegie Institution, scientists found that the pressure reaches 50 million pounds per square inch. In appearance the anvils used are cylindrical in

shape. The cylinder plates presses together tips of two small diamonds, each a quarter to half a carat, typically no bigger than a quarter of an inch. On one diamond tip, a notch shaped like the caldera of a volcano has been carved to trap the material that is to be squeezed. The other tip presses down the material.

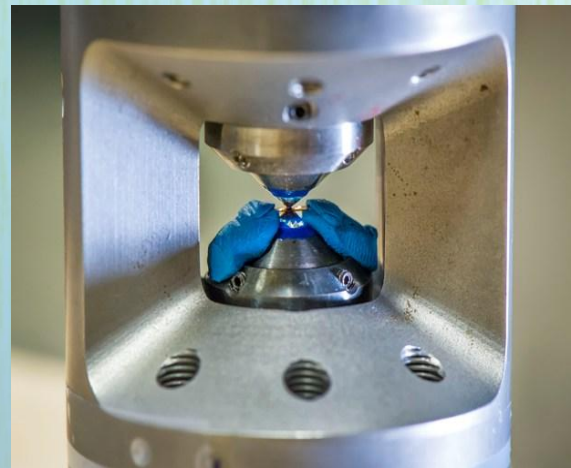


Figure 1: Diamond Anvil

The screws on the cylinders apply only a few pounds of force. But those translate into tremendous pressure because the diamond tips are small in area. After all, Pressure is just force divided by area.

### CONCLUSION

So far this concept of science has led to the creation of a new effective photovoltaic cell from the mixture of silicon and sodium that is used to produce powerful solar panels which reduces the cost of power and consumption of oil. New substances formed from this technique allow for cheaper production of metals.





## IEA PROFILE

The Instrumentation Engineers Association, comprising the Instrumentation technocrats of the prestigious MIT, is a student body, working towards the betterment of students in every domain. The roots of the Association are Dr.J.Prakash, the HOD of Electronics and Instrumentation, final year students' Faculty Advisor Mrs.C.Shanthi (Treasurer, IEA) and an inevitable clique that comprises the Chairman, the Vice-Chairman, the Secretary and the Joint Secretary under the guidance of other staffs, altogether striving for the progress of the Association.

Education must not be confined to the classrooms. In order to make the students stay in today's contention; the students must be exposed to a sufficient industrial ambience, peer-peer learning, proper guidance about various career opportunities and whatsoever possible. This entire process is ensured and enacted by the IEA.

A good career is every student's dream. The IEA helps the students to realise their dream by scheduling various activities. Few such activities include aptitude tests, mock-interviews and seminars, group discussion sessions and many other interactive sessions conducted by the seniors, which will help the students get into the corporate world. The IEA in collaboration with the Alumni Association not only increases the chances of bringing many companies but also makes the students aware of various opportunities outdoor. At the same time, IEA, for the purpose of feeding a healthy dose of balanced theoretical knowledge and industrial knowledge, has been arranging many guest lectures on a variety of topics.

To enumerate a few of them,

1. Dr. M. Nazmul Karim, Head, Chemical Engineering department, Texas A&M University- An introduction to control of biological processes
2. Mr. Sivagnanam, Latin America Distribution Head, Emerson- Control Valve sizing

The IEA, under the guidance of the HOD, has mentored the junior students on their summer projects to help them gain expertise on the working of various instruments and components. This motivation fed by the IEA, in addition to helping them get some knowledge under their belts, also updates them with the modern technology.

IEA has put sedulous efforts for the success of its intra-college technical symposium, the LIVEBEAT and now its inter-college technical symposium, the INTECHO. The latter is a national level technical symposium that comprises various technical activities which would bring the acing technocrats to light.

In sum, the Instrumentation Engineers Association can be likely called a democracy, for it is the association of the students, by the students and for the students.





## IEA INAUGURATION 2013

Instrumentation Engineering Association (IEA) was the first event to be conducted during the start of the academic year 2013-2014. The inauguration was presided by **B. Sai Ramesh**, General Manager (Engineering), Technip India Limited. He delivered a speech regarding the challenges faced in 'oil exploration' in the mid sea and gave an enthusiastic start off for IEA.

## LIVEBEAT 2013

**S.Balasubramanian**, Engineering Manager, Global Services, Honeywell inaugurated the symposium with an informative address on "foundation field bus". The event turned out to be tremendously successful and witnessed healthy participation from our department and from other departments as well. Mr & Ms instrue was one of the successful events where the students were examined based on their talents in various aspects. We also had a unique Idea Presentation event wherein our students came up with innovative and effective ideas to improve our campus.

## RTIC and TIIMA -13

In this year, Department of Instrumentation Engineering, The MIT Campus, Anna University witnessed two conferences- a national level conference and an international one. The National Conference on **Recent Trends in Instrumentation and Control (RTIC-13)** was held on 22nd & 23rd March, 2013 in the department and it had the participation by scientists, academicians and practicing engineers from all over the nation to discuss the latest developments in the field of Instrumentation and Control. **Trends in Industrial Measurements and Automation (TIMA-13)**, the 8th International Conference was held during 22nd-24th December, 2013. Trends in Industrial Measurements and Automation (TIMA) is a forum constituted by the Central Electronics Engineering Research Institute (CEERI) Centre Chennai, The MIT Campus, Anna University and The International Society of Automation, South India Section (ISASOIND). TIMA-2013 was successful in realising its main objective of bringing together the International community of Instrumentation and Automation Engineers, Scientists and Academicians to a common platform to discuss the state-of-the-art research results and perspectives of future developments relevant to the field.





## STAFF PROFILE

### RESEARCH PAPERS PUBLISHED AND PRESENTED

1. F Kiasi, **J Prakash**, SL Shah, presented a paper titled "An Alternative Approach to Implementation of Generalized Likelihood Ratio Test for Fault Detection and Isolation", Industrial & Engineering Chemistry Research, 2013.
2. **J Prakash**, SR Jayasurian, published a paper on "Design and Implementation of Fractional-Order Controller for Fractional Order System", in Recent Advancements in System Modelling Applications, 319-326, 2013
3. V.Rajinikanth, **K.Latha**, published a research paper titled "Controller parameter optimization for nonlinear systems using enhanced bacteria foraging algorithm", in the field of Applied Computational Intelligence and Soft Computing, 2012.
4. **N. Pappa**, T.Babu published a paper on "Design of Robust PID Controller using Hybrid Algorithm for Reduced Order Interval System", Asian Journal of Scientific Research, Vol 5 (3), 108-120, 2012.
5. **K. Kamalanand** and **S. Srinivasan**, authored a paper on "Modeling of Normal and Atherosclerotic Blood Vessels using Finite Element Methods and Artificial Neural Networks", in World Academy of Science, Engineering and Technology, Vol. 60, pp. 1314-1317, Dec. 2012
6. SakthivelMurugan. S and **Natarajan. V**, published a paper on "Implementation of Threshold Detection Technique for Extraction of Composite Signals against Ambient Noises in Underwater Communication using Empirical Mode Decomposition", Fluctuation and Noise Letters, Vol.11, No.4, 2012
7. Esakkiappan, C. and **Thyagarajan, T**. Presented a paper titled, "Improved Auto Tuning for Integrating Process with Time Delay using Relay Feedback Test", Mediterranean Journal of Measurement and Control, 2012.
8. **K. Kamalanand**, P. MannarJawahar (2012), presented a paper on "Estimation of HIV-1 Viral Load from CD4 Cell Count using Bacterial Foraging Optimization and Three Dimensional HIV/AIDS model", in Proceedings of 1st Asian Conference on Hepatitis B and C, HIV and Influenza, 18 – 19 May 2012, Beijing China

### AWARDS AND HONOURS

- Dr.T.Thyagarajan has been awarded THE IEEE GOLD/WIE, MENTOR AWARD 2008.
- He also received the certificate of Appreciation for contributions to IEEE as Chair, 2010-2012
- Dr. J.Prakash has been awarded ISA-Emerging Leader 2011
- He is also honored with DST BOYSCAST fellowship
- Mr.Kapil Arasu received Canadian common wealth scholarship





## STUDENT ACHIEVEMENTS

### FOURTH YEAR

- Nagineni Varun Chowdary, Sukanya. S presented a paper titled “Robust controller design for Integrator plus time delay systems using Kharitonov theorem” at the 8th International conference on Trends in Industrial Measurement and Automation (TIMA – 2013.)
- Nagineni Varun Chowdary, Sukanya. S presented a paper titled “Effect of Heart rate on the accuracy of Oscillometric blood pressure measurement” in the National conference on Recent Trends in Instrumentation and Control (RTIC – 2013).
- Sukanya. S scored 328/340 in GRE.
- Nagineni Varun Chowdary scored 316/340 in GRE.
- B. Koushik scored 316/340 in GRE.
- Swaminathan T.C came first in Pyramix at Shaastra cube open, IIT-M. He has delegated various cube competitions in various institutions across India including IIT-D, IIT- Guwahati, BITS Pilani, BITS Hyderabad, NIT Trichy etc and has won several awards.
- S. Sriramana and B. Koushik were a part of the zonal winning chess team, 2012. The team was further ranked 4<sup>th</sup> in the State level Chess championship
- B. Koushik was a part of the chess team which came 2<sup>nd</sup> in the 2013 zonal Chess championship.
- T. Piranava scored 314/340 in GRE.
- Vignesh. B scored 315/340 in GRE.
- Rizwana Begum. S won second place in table tennis at zonal level.

### THIRD YEAR

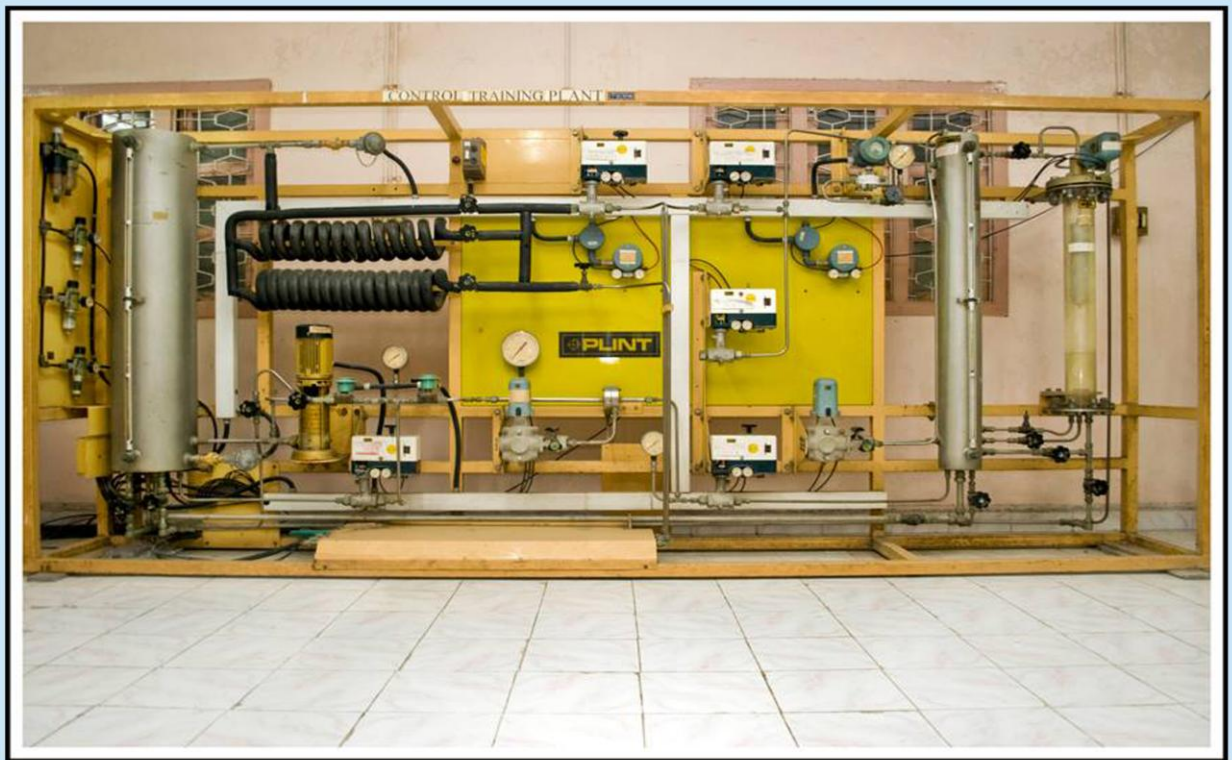
- S. Shri Shankari, A. Girish Gowtham published a paper titled “Signal Strength Enhancer” at ICEEECSME, 10<sup>th</sup> IRAJ International Conference.
- Nithyadharshini.S, Keerthana.V won second prize in Paper presentation at “Electronica”, Kodaikanal Institute of Technology.
- Srihari Vignesh.R scored 326/340 in GRE.
- Rudhrapriya.R won second place in Badminton at Chemfest’ 13 held at Chengalpet Medical College.
- Madhumitha.V won silver medal in Badminton Zonal championship held at MIT.

### SECOND YEAR

- Vasanth Kumar was awarded Young scientist award at the National level by the Tamil Nadu science forum.
- C.R. Vidhya Prasad has secured first place in quiz at the state level talent expo conducted by the Tamil Nadu education board.
- Aishwarya. M has participated in the Common wealth games for Taekwondo. She went to the Indian camp for Olympics and has won several gold and silver medals in the National and State level.
- P. Allwin Bebeto won bronze in Hockey at the zonal level.

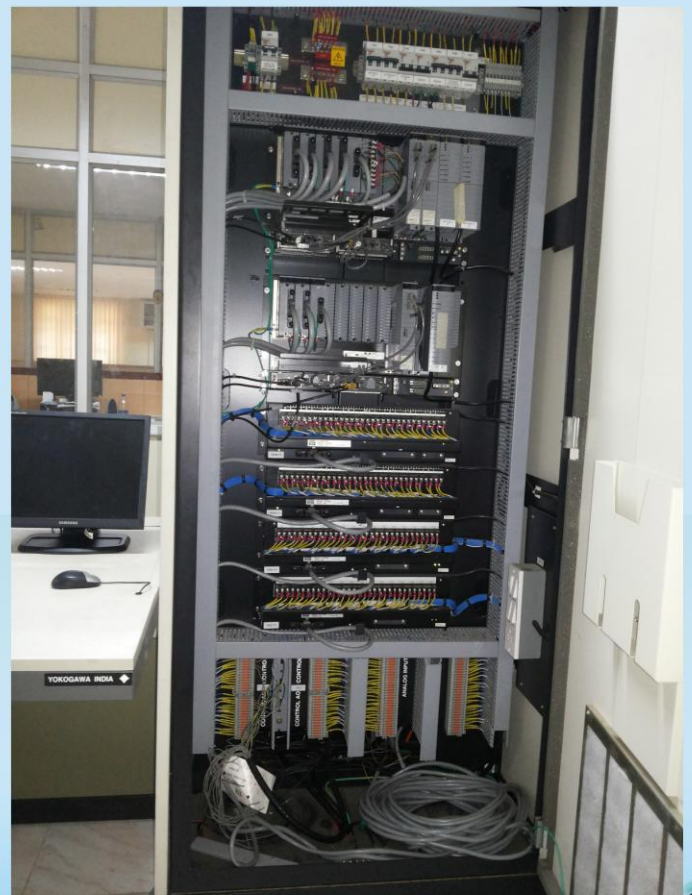






PROCESS CONTROL LABORATORY

FIELDBUS LABORATORY

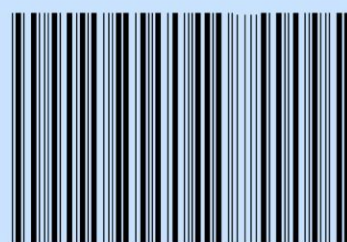
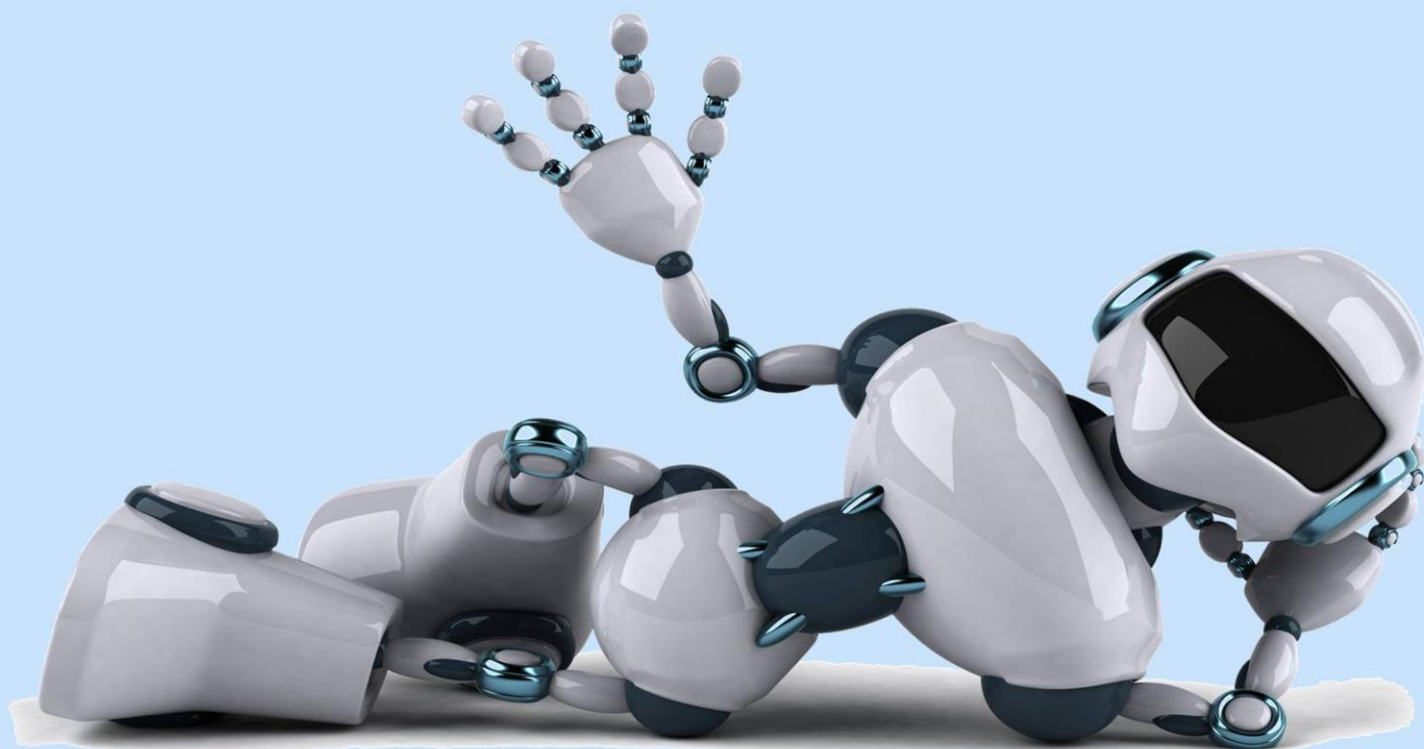






# INTECHO '14

*Automation - the next step to Utopia*



INSTRUE 5.0