Compendium on R&D Projects

under the Grant-in-Aid-Scheme

Volume 6

September 2017

The Institution of Engineers (India)

8 Gokhale Road, Kolkata 700020

A Scientific and Industrial Research Organisation
recognised by Department of Scientific and Industrial Research
Government of India
ISO 9001:2008 Certified

The Institution of Engineers (India)

(Established in 1920. Incorporated by Royal Charter in 1935)
8 Gokhale Road, Kolkata 700020
Phone: +91 33 22238311/14/15/16, Fax: +91 33 22238345
Website: www.ieindia.org

The Institution of Engineers (India) or IEI is the largest multidisciplinary professional body that encompasses 15 engineering disciplines and gives engineers a global platform from which to share professional interest. IEI has membership strength of over 0.8 million. IEI functions among professional engineers, academicians and research workers. It provides a vast array of technical, professional and supporting services to the Government, Industries, Academia and the Engineering fraternity, operating from 121 State/Local Centres located across the country.

IEI conducts Section A and B Examinations in different Engineering disciplines, the successful completion of which is recognized as equivalent to Degree in appropriate field of Engineering of recognized Universities of India by the Ministry of Human Resources Development, Govt. of India. Every year as many as 90000 candidates appear for these exams. for details, please see: **www.ieindia.org**

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In order to promote Research and Development by students of undergraduate and post-graduate levels and Research Scholars of Engineering Institutes, IEI provides grant to selected projects in every year. For Guidelines and Format of Application please visit: www.ieindia.org

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The SAIL Awards - for the best paper, broadly pertain to the Iron and Steel Industry, invited and received by the Institution on the subjects announced each year through the Institution publications

The Coal India (J G Kumaramangalam Memorial) Award - for the best paper, broadly pertains to the mining industry, invited and received by the Institution on the subject announced each year through the Institution publications.

Apart from the above, best papers published in IEI Journals are awarded every year during the Indian Engineering Congress.

Message from the President

It has been a pleasure to note that the Compendium on R&D Projects under IEI R&D Grant-in-Aid Scheme, Volume 6 is being published successfully. The content is truly enriching and it is appreciated that The Institution of Engineers (India) is reaching out to young talents and shaping their dreams.

It is also heartening to see that these research outcomes have been published in reputed International Journals thereby providing an enhanced visibility to our activities. I am also pleased to note that a modest 'Fellowship Scheme' for students, who are pursuing PG/PhD courses especially in Institutions which are self-supporting in nature, has been initiated. This will nurture and shape the career of many young talents across the country.

I believe that the present compendium will bring in smart, enthusiastic and fresh thinking into R&D activities and script many more success stories in the days ahead.

Mr Navinchandra B Vasoya
President, IEI

Message from Chairman
Committee for Advancement of Technology and Engineering

Being recognized by the Ministry of Science and Technology, Govt. of India as a Scientific and Industrial Research Organization, The Institution of Engineers (India) has taken up the role of promoting R&D through funding and active participation in meaningful R&D ventures. The initiative was launched way back in 2001 with a modest amount of fund where the role of the Institution was confined to that of a mere funding body. The modest enterprise has now manifested into a full-fledged program which has percolated to the student community across the country. The role of the Institution has also undergone a paradigm shift from that of a technology funding body to that of a technology collaborator and facilitator. We are pleased to mention that several research works carried out from these R&D funding have been published in the IEI-Springer Journals which speaks volume about the success of the initiative. A Fellowship Scheme has also been instituted to provide support to meaningful PG/PhD projects.

The 'Compendium on R&D Projects' is a reflection of IEI funded research carried out in the frontier areas of technology. The sixth volume is being brought out with the objective of showcasing the talent pool of engineering students that we are proud to nurture and support.

Dr K Venkatasubbaiah,
Chairman, CATE

Message from Chairman
Research & Development Committee

The Grant-in-Aid scheme was instituted by The Institution of Engineers (India) way back in 2001 with the objectives of nurturing innovative thinking and fresh talents in technology and engineering and thereby providing a student with the opportunity to develop their technical skills and gain insight into latest researches in the field. The scheme intends to provide funding to engineering students, for their innovative projects at Diploma, UG, PG & PhD level and also provide the students with a platform to commercialize their creation in the form of Intellectual Property Rights (IPR) such as copyrights/patents etc, fine tune their practical and technical skills in a laboratory environment and translate their experience into tangible career and employment opportunities.

Also, in order to support purposeful post graduate and doctoral level initiatives, a fellowship scheme has been instituted for students pursuing PG & PhD courses in Engineering for the FY 2017-18. We take pride in informing that our efforts have been duly recognized by the Ministry of Science and Technology, GoI who have identified the Institution as a Scientific and Industrial Research Organization (SIRO).

Like every year, it has been a pleasure to bring out the Compendium on R&D Projects under IEI R&D Grant-in-Aid Scheme, Volume 6, which provides a glimpse of the versatile range of projects carried out with modest funding from IEI most of which have deep social implications.

Dr K Gopalakrishnan
Chairman, R&D Committee

IEI – Springer Journal Series

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The Institution of Engineers (India) has tied up with Springer, a reputed publisher in the Worlds to increase the visibility, greater acceptability, impact factor and SCOPUS Indexing of the Institution Journals. The tie up added a greater value to the publish research works and results in quantum jump in the circulation of the Journals to a wide spectrum of learned community.

The details of scheduled publications by Springer and the subscription rates are given hereunder :-

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For any query regarding subscription for IEI Journals (Series A to E) and details of payment, please contact :-

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Serving the Nation and Society since 1920

The Institution of Engineers (India)

Volume 6, September 2017

Contents

Compendium on R&D Projects under IEI Grant-in-Aid Scheme

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F. No. 11/97/88-TU-V Date: 1 July, 2016

The Director
The Institution of Engineers (India)
8, Ghokhale Road
Kolkata-700020
West Bengal

Subject: Renewal of Recognition of Scientific and Industrial Research Organisations (SIROs).

Dear Sir/Madam,

This has reference to your application for renewal of recognition of The Institution of Engineers (India), Kolkata, West Bengal as a Scientific and Industrial Research Organisation (SIRO) by the Department of Scientific and Industrial Research under the Scheme on Recognition of Scientific and Industrial Research Organisations (SIROs), 1988.

2. This is to inform you that it has been decided to accord renewal of recognition to The Institution of Engineers (India), Kolkata, West Bengal from 01.04.2016 upto 31.03.2019. The recognition is subject to terms and conditions mentioned overleaf.

3. Receipt of this letter may kindly be acknowledged.

Yours faithfully,

(Dr. S.K. Deshpande)
Scientist - 'G'

Experimental Investigations of Bond Characteristics of Steel-concrete Composite Interface Connected by Adhesive Bonding

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OBJECTIVE

- The various objective of the research project are as follows:
- To analyse the behaviour of adhesive bonded steel-concrete composite specimens under monotonic loading.
- To determine the maximum load carrying capacity or direct shear bond capacity of connection.
- To develop a connection between steel and concrete with the help of adhesive bonding.
- To calculate the appropriate thickness of adhesive material for perfect bonding between steel and concrete.
- To determine the consequent relative slip along with the shear stress and load values.
- To determine the impact strength of specimen shaving adhesive bonded and headed stud connected connections.

Adhesive bonded composite specimen subjected under drop weight impact test

Adhesive bonded steel-concrete composite specimen connection interface failure

ACHIEVEMENTS

The results obtained from the study on adhesive bonded and mechanically connected steel-concrete composite specimens under monotonic loading provide means for quantitative estimation of ultimate capacity and engendered slip at the interface. This observation may help in deciding the composite behaviour of connection under static loading.

The connection between steel and concrete was established through extensive trials at composite interface by epoxy and polyurethane based adhesive.

The effects of change in adhesive thickness on the capacity of connection, engendered slip at the interface were studied. Optimum thickness for adhesive bonded connection was achieved at three millimetres.

The load-slip curve for different thicknesses were quantified experimentally, calculated and plotted.

Composite behaviour of adhesive bonded and mechanically connected connection under extreme (impact) loading was studied. The experimental study demonstrated that the number of blows required for crack initiation for adhesive bonded composite specimen was higher than that required for the initial failure of mechanical stud connected specimen while, number of blows required for the final failure of adhesive bonded composite specimen were less than that required for causing slip of 3 mm in mechanically connected specimen.

The mechanically connected specimens were found to be more ductile than adhesive bonded composite specimens.

PUBLICATIONS

Kumar, P., Chaudhary, S., & Gupta, R. (2017). Behaviour of Adhesive Bonded and Mechanically Connected Steel-concrete Composite under Impact Loading. Procedia Engineering, 173, 447-454.

Kumar, P., Patnaik, A., & Chaudhary, S. (2017). A review on application of structural adhesives in concrete and steel–concrete composite and factors influencing the performance of composite connections. International Journal of Adhesion and Adhesives.http://dx.doi.org/10.1016/j.ijadhadh.2017.03.009

Developing a Novel Technique for Identification of Victims/ Criminals of Sexual Exploitation on Women and Children

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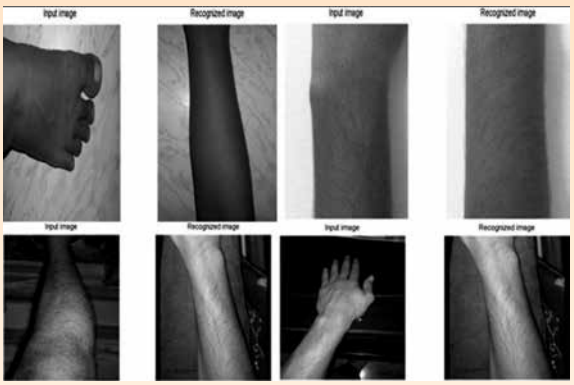
OBJECTIVE

- To develop and analyse various existing techniques for identification of criminals/victims of child pornography.
- To develop a novel technique for identification of criminals/victims in low resolution images of child pornography.
- To implement the developed novel technique which involves fusion of permanent pigmented (vascular) skin marks, vein pattern, androgenic hair pattern on C6 Integra (DSP+ARM) board.
- To validate the developed system on various standard public databases consisting of skin images and androgenic hair patterns.

C6 Integra (DSP + ARM) implementation of the developed system



Testing developed system on various body part images

ACHIEVEMENTS

The achievements of the developed system are as follows:

- An input RGB image is transformed and normalized to localize skin colors and the normalized RGB color space removes the effect of illumination variations.
- A vein uncovering method is developed to visualize the hidden blood vessel pattern in the RGB image.
- The visualized vein pattern is then extracted and matched with another vein pattern in a database to obtain a vein dissimilarity score.

- Permanent Pigmented and Vascular Skin Marks are used as biometric traits in the developed system for identification in cases where the evidence images show only the non-facial body parts of the criminals or victims, such as in child sexual abuse and riots.
- Skin mark patterns cannot be viewed from a distance hence androgenic hair patterns is used to overcome the weakness.
- The uncovered androgenic hair and vein patterns are then extracted using a Gabor filtering-based vein pattern extraction method and represented in a point set for matching.
- The vein pattern point set is then matched with other vein patterns in a database using a 3-step vein pattern registration method, which includes a registration of the arm boundary, a registration of vein patterns, and a registration of vein patterns to determine correspondence points.
- A vein dissimilarity score based on distance and vein segment orientation differences is calculated [1].
- For algorithm development and system evaluation, color images of various body parts were collected from people of age group 2 years to 70 years.
- To simulate a suspect and evidence database, images were collected in different pose and viewpoint conditions.
- Two common characteristics were observed from the images collected in the standardized setting. First, pixels of skin representing different parts of the human body (e.g., back, chest, arm, and thigh) form homogeneous groups of pixels in the images, and second, skin is usually the largest homogeneous region in the images [2].
- Based on these two properties, the Fuzzy C-Means (FCM) algorithm was adopted for skin segmentation.
- The k-Nearest Neighbor algorithm with k = 3 is used to find vascular skin mark correspondences between the suspect and evidence images in the normalized coordinate system.
- A vascular skin mark dissimilarity score based on distance and vascular skin segment orientation differences is calculated [3].
- The local binary pattern was used to evaluate the proposed algorithm on androgenic hair patterns in very low resolution images.
- An androgenic hair pattern obtained was then matched using sparse representation classification. The sparse representation-based classifier was developed for pattern classification [4].
- An androgenic hair pattern dissimilarity score based on distance and androgenic hair segment orientation differences was calculated.
- The RPPVSM matching score is then fused with the normalized vein matching score, if the vein patterns match very well (i.e., the normalized vein matching score is 0.85 or higher), the fusion score is calculated.
- Conventional Neural Network architecture was used to make the final decision because it consists of fused convolutional and sub sampling layers.
- Implementing of the system was performed on C6 Integra (DSP + ARM) embedded device because it's system-on-chip (SoC) is very well suited for products requiring intensive image processing packages.
- C6 Integra contains comprehensive system control, a responsive graphical user interface and the ability to run applications under advanced operating systems. This integration saves board space, power consumption, manufacturing costs and discrete memory costs and allows for faster performance due to the high-speed interconnect between two cores.

- Open CV along with Python programming language was used on C6 Integra to develop the system which contains Ubuntu operating system.

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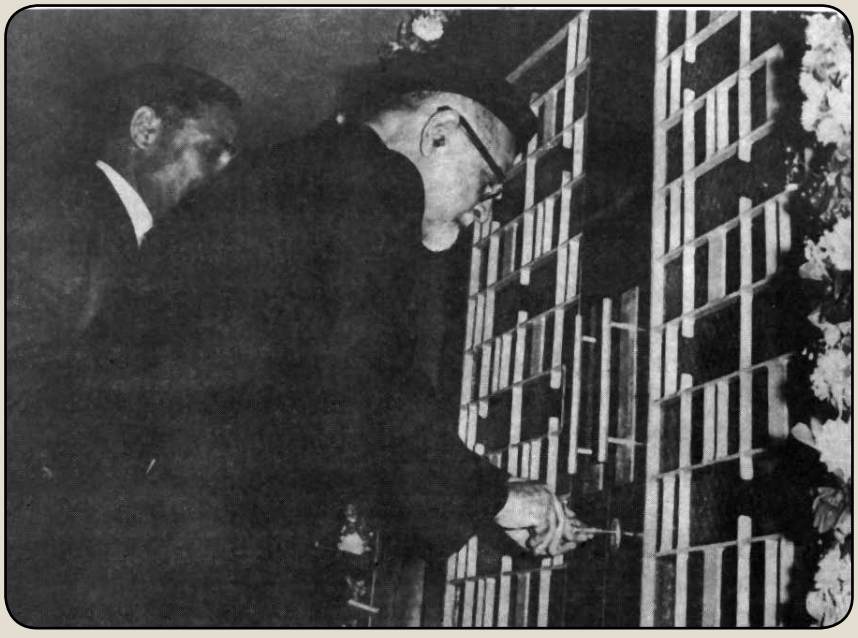
2. H.R. Sharifzadeh, H. Zhang, and A.W.K. Kong, "Vein Pattern Visualization through Multiple Mapping Models and Local Parameter Estimation for Forensic Investigation," in Proc. ICPR, 2014 .
3. H. Zhang, C. Tang, A. Kong, and N. Craft, "Matching Vein Patterns from Color Images for Forensic Investigation," in Proc. BTAS, pp. 77-84, 2012.
4. H. Zhang, "Blood Vessel Pattern Matching, "Vein Identification for Forensic Investigation", PhD thesis, Nanyang Technological University, Singapore, 2014.

PUBLICATIONS

The project results obtained are published in ACM digital library titled "Robust Human Skin Detection using Open CV on ARM based ODROID XU4 Heterogeneous Multi-Processing Device" Article No. 86, August (2016), DOI:10.1145/2905055.2905297

Legacy of IEI



Dr Zakir Husain, President of India, opening the Main Door of the New IEI Headquarters Building

Smart Energy Meter

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OBJECTIVE

To develop a Domestic energy monitoring equipment that indicates the cost of Electrical energy consumption. This enables the consumers to monitor their energy consumption and adjust their consumption patterns accordingly. The Smart Energy Meter evolving from the Real time Energy Monitoring System (RTEMS), proposes provides a useful comparison of energy patterns compared to standard meters. With this knowledge, positive steps can be taken to save more energy at home. Lt also helps to make informed decisions about the energy usage. This has a positive impact on consumption levels and the consequent amount of money spent. A smart energy meter replaces the standard electricity meter.

Final Prototype

Prototype under testing

ACHIEVEMENTS

In this project we have proposed a smart energy meter that provides the consumers awareness about their energy consumption. The energy crisis is increasing day by day, so it is important to save energy. Proper energy management can be done through proper load management. This can be well supported through the introduction of smart energy meter. This is a real time monitoring equipment that plays a vital role in conserving energy. With this equipment we can take positive steps to save energy at home. This can have a good impact on our levels of consumption and on the amount of money we spend. Make consumer friendly application that's runs on Android platform displaying voltage,current, power, power factor, energy and cost and gives an alert message when the power consumption exceeds a particular limit for a particular period of time. This information are uploaded to the cloud so that this can be accessed from anywhere in the world.

Logo based Document Image Retrieval System

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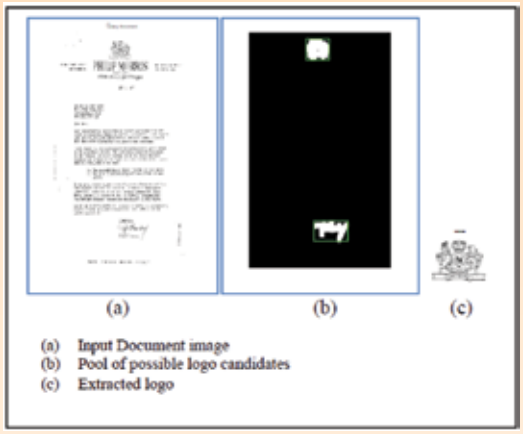
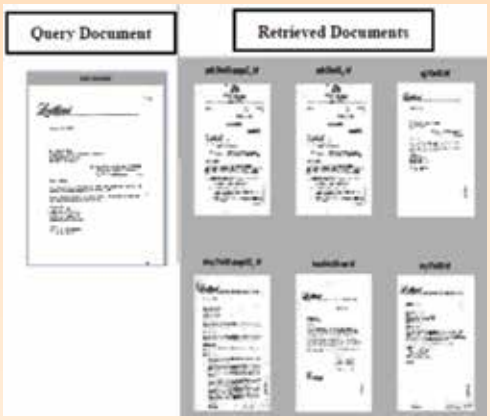
OBJECTIVE

Development of information technology has lead to generation of huge number of document images in daily life. Hence there is a challenge in searching and retrieving appropriate documents related to the query. Logo based document image retrieval provides one of the solution to search and access document images. Hence, objectives of the proposed work include:

- Developing a novel method for automatic logo detection from query document image
- Implementing technique for logo based document image retrieval system
- Testing the developed logo based document image retrieval system



Logo detection from the document image



Query and Retrieved Documents

ACHIEVEMENTS

- We proposed a novel method for automatic logo detection and logo based document image retrieval system using an algebraic tool Singular Value Decomposition.
- Using the proposed model an average logo detection rate of 89.52% was achieved.
- The developed logo based document image retrieval system provides a precision of 84%.

PUBLICATIONS

- Umesh D. Dixit and M. S. Shirdhonkar, "Automatic logo detection and extraction using singular value decomposition", 5th IEEE International Conference on Communication and Signal Processing, (ICCSP'16), Melmaruvathur (Tamil Nadu), pp. 644-647, 2016.
- Umesh D. Dixit and M. S. Shirdhonkar, "Logo based Document image Retrieval System using Singular Value Decomposition features", IEEE International Conference on Signal and Image Processing, (IConSIP 2016), Nanded (Maharashtra), pp. 169-172, 2016. (To be published in IEEE Xplore digital library).

Studies on Enhancement of Charging/Discharging Characteristics of an Encapsulated Latent Heat Thermal Storage Unit

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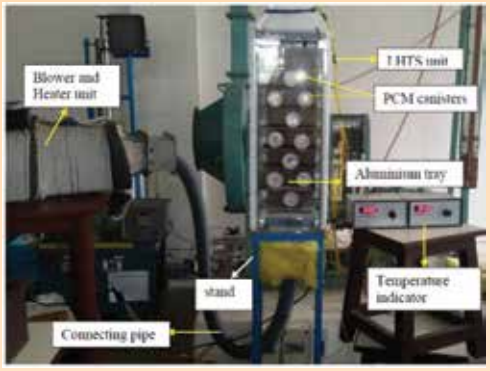
OBJECTIVES

The present work focuses on investigating the performance of a multiple PCM LHTS unit employing commercial RT type PCMs imported from Rubitherm, Germany. The major objectives are:

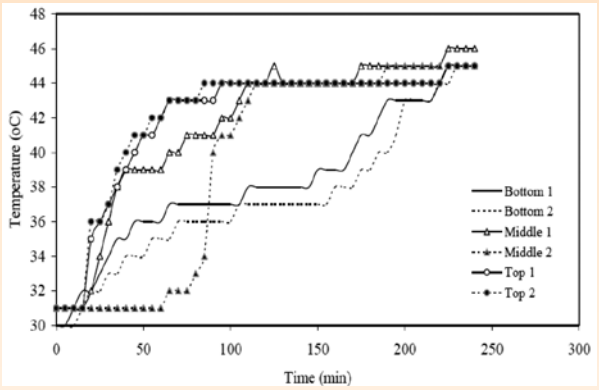
- To investigate numerically the influence of the different operating/thermophysical parameters on the performance of a single PCM LHTS unit
- To investigate experimentally the performance of both single and multiple PCM LHTS units with a vertical storage unit designed and fabricated for the purpose.



Multiple PCM experimental setup

ACHIEVEMENTS

1. A latent heat thermal storage unit employing multiple PCMs was designed and fabricated.
2. The real time charging and discharging characteristics of commercial RT PCMs like RT31, RT35 and RT42 were obtained.



Temperature distribution within the multiple PCM unit during charging

PUBLICATIONS

1. Lakshmi Narasimhan N. and P. Karthik, Evaluation of key design parameters of an encapsulated latent heat thermal storage unit, Applied Mechanics and Materials, 2016, Vol. 852, pp 652-658.
2. Lakshmi Narasimhan N. and P. Karthik, Experimental Studies on the Performance of a Multiple PCM Thermal Storage Unit. Accepted for Presentation. 2nd International Conference on Recent Advancements in Chemical, Environmental & Energy Engineering (RACEEE-2017), February 23-24, 2017, SSN College of Engineering, Kalavakkam-2017.
3. Karthik. P., Studies on single and multiple PCM latent heat thermal storage units, M.E. (Energy Engg.) Thesis submitted during June 2016, Dept. of Mechanical Engineering, SSNCE, Kalavakkam, Tamil Nadu.

Studies on Designing of Durable Superhydrophobic Surfaces for Outdoor Insulators

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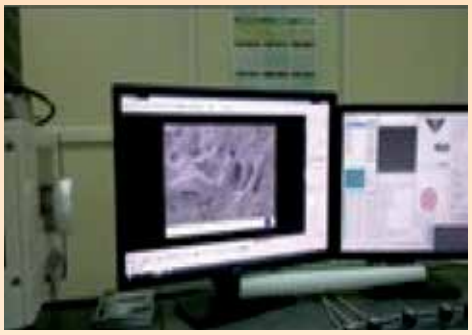
OBJECTIVES

The main objective of this project was to design durable superhydrophobic surface for outdoor insulators. Apart from making its surface superhydrophobic the distribution of electric stress as well as the thermal stress over the insulator surface has to be uniform in order to increase the life of the same i.e. to make it durable.

In this project the first target was to achieve reduction in electrical stress over silicone rubber by mixing different proportion of weights of metal oxide nanofillers with silicone rubber.



FESEM Analysis of one of the samples

Capacitance and Tan delta testing of one of the samples

ACHIEVEMENTS

The samples have been fabricated by mixing titanium oxide in different proportion by weight with the industry graded silicone rubber (RBB 2888-60). These compoundings were verified by the Field Emission Scanning Electron Microscopy (FESEM) analysis and they have been found to be uniform.

Electrical properties of the prepared samples were obtained. These include capacitance, dielectric loss angle for different frequencies at different voltage levels. From the obtained values, dielectric constants, electrical conductivities and dielectric losses have been calculated. The breakdown voltages of the fabricated materials have also been measured.

Thermogravimetric analysis (TGA) and differential thermal analysis (DTA) have been done to obtain the thermal properties of the samples. From DTA and TGA analysis the phase transition of the fabricated materials have been analysed. Accordingly specific heats and thermal conductivities of the samples have been obtained.

Simulation of electric stress over a post insulator surface stressed between the live electrode and the ground electrode and the distribution of equipotential lines on and around it has been studied. The results obtained were compared by considering the insulator to be made of different samples of the compounded that were fabricated with respect to the results obtained for the sample made only with silicone rubber without mixing any nanofillers.

Promising results have been obtained with nanofiller compounded silicone rubber samples as compared to those without nanofiller compounding. Considerable reduction in electric stress has occurred over the insulator surface using nanocompounded silicone rubber.

PUBLICATIONS

A. K. Pal, A. Baral and A. Lahiri, "Electric Stress Control on Post-Type Porcelain Insulators Using a Coating of RTV Silicone Rubber with BaTiO3 Nanofillers", 3rd International Conference on Foundations and Frontiers in Computer, Communication and Electrical Engineering(C2E2), pp. 387-390, West Bengal, India, 15th-16th January, 2016.

R&D Grant-in-Aid Scheme (2017-18)

The Institution of Engineers (India), the apex body of the engineers of India provides Grant-in-Aid support to its Corporate Members, Student Members and Institutional Members to pursue research and development in the field of engineering and technology.

Salient Points of IEI R&D Grant-in-Aid

Project Category	Institutional Membership	Guide	Student/ Applicant Membership	Quantum of Grant	Project Duration
Diploma	Not Mandatory	Should be Corporate Member(s)	Not Mandatory	Not exceeding Rs 20,000/- for a single project	Not exceeding six (06) months
Under Graduate (UG)	Institutional Member will be preferred	Should be Corporate Member(s)	Not Mandatory (Preferably an SMIE)	Not exceeding Rs 50,000/- for a single project	Not exceeding six (09) months
Post Graduate (PG)	Institutional Member will be preferred	Should be Corporate Member(s)	Should be Corporate Member(s)*	Not exceeding Rs 1,00,000/- for a single project	Not exceeding twelve (12) months
Doctoral (Ph. D)	Institutional Member will be preferred	Should be Corporate Member(s)	Should be Corporate Member(s)*	Not exceeding Rs 1,50,000/- for a single project	Not exceeding Twenty-four (24) months
*At the time of application they may not have membership, but before release of grant they must obtain membership of IEI					

The soft copy of the duly filled-up applications (in editable format), as per the given proforma available in our website, should be sent through email to research@ieindia.org and two hard copies of the same should reach the following address:

Director (Technical)
The Institution of Engineers (India), 8 Gokhale Road, Kolkata 700 020

Applications received in format other than that available on our website will not be accepted. Application should be forwarded through the Guide, Head of the Department or Head of the Institution. Please note that preference will be given to project proposals received from Institutions who are members of The Institution of Engineers (India). Kindly go through the guidelines (visit link https://www.ieindia.org/PDF_IMAGES/R&D/General%20Guidelines.pdf) carefully before filling up the application. The grant is not intended for the faculty members who have access to other avenues of research funding. Proposals received are scrutinized on a fortnightly basis and the recipients of R&D Grants are informed accordingly. Sanctioned projects are uploaded in IEI Website periodically.

Investigations for Mechanical Properties of Nylon6-SiC-Al_2O_3 based Feed Stock Filament for Fused Deposition Modelling (FDM)

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OBJECTIVES

- To develop feed stock filament for FDM with Al_2O_3 reinforcement as single particle size (SPS), double particle size (DPS), triple particle size (TPS) in Nylon6 matrix
- To investigate the effect of particle size ie, SPS, DPS , TPS on mechanical properties of developed feed stock filament material
- Optimization of process parameters for feed stock filament of FDM, namely :
  Tensile Strength, Dimensional Accuracy, Young's Modulus, Yield strength, %age elongation
- To develop feed stock filament with hybrid reinforcement (SiC and Al2O3) in Nylon matrix
- To investigate the effect of hybrid solute on properties of developed feed stock filament material (like: tensile strength, percentage elongation, Young modulus etc.)

Stratasys FDM machine

Pins prepared on FDM

ACHIEVEMENTS

As an outcome of this research project, an alternative feed stock filaments with Al_2O_3 reinforcements as SPS, DPS and TPS in Nylon6 matrix have been successfully developed. The empirical relations for mechanical properties have been successfully developed and counter verified. Finally it is concluded that in-house prepared FDM feed stock filament with tailor made properties can be successfully used (based upon industrial applications). Along with this an alternative feed stock filament with hybrid reinforcements as SiC and Al_2O_3 in Nylon6

matrix has been successfully developed. The MFI of feed stock filaments prepared with SiC and Al_2O_3 were comparable to the ABS filament used conventionally in FDM. The mechanical properties (like: Percentage elongation, Young's Modulus, Yield strength) have been optimized to increase the application domain FDM. The empirical relations for mechanical properties have been successfully developed and counter verified. Finally it is concluded that in-house prepared FDM feed stock filament with tailor made properties can be successfully used (based upon industrial applications). The outcomes for the present work show feasibility of development of FDM wire from alternative material. As ABS wire is having limited wear properties so alternative material can be used to have tailor made properties. This project is in line with the Government of India initiatives of Make in India as alternative feed stock filament with tailor made mechanical and wear properties have been developed indigenously (in house) and that too at very low cost. The expected beneficiaries of the project are FDM consumers specially field engineers/persons involved in development of functional/ non functional prototypes who have to pay high cost of consumable (in form of spool of wire) to manufacturer (as because the commercial wire spool is a patented material and it is available at high cost around Rs 24,000/- per spool in India). The alternative wire spool developed is of around Rs 250-300/- per spool which is much cheaper and can be used for unlimited rapid tooling applications. This work is major breakthrough in enhancing the application domain of the FDM process.

PUBLICATIONS

Effect of single particle size, double particle size and triple particle size Al_2O_3 in Nylon-6 matrix on mechanical properties of feed stock filament for FDM, Composites Part B: Engineering, Vol. 106, 2016, 20-27.

M.Tech Thesis

1. Experimental investigations for mechanical properties of Nylon6-SiC-Al_2O_3 based feed stock filament for FDM.
2. Effect of Single particle size, double particle size and triple particle size Al_2O_3 in Nylon 6 matrix on mechanical properties of feed stock filament for FDM.

IEI MEMBERSHIP

The Royal Charter defined the classification of membership and only 5 classes; namely, Honorary Life Member, Honorary Member, Members, Associate Members and Companions were known as Members of the Institution. However, through decades of modifications, changes and demands of the engineering challenges and of the engineering profession the present Bye Laws of the Institution categorized the membership under several classes; they are (a) Honorary Life Fellow (b) Honorary Fellow (c) Fellow (d) Member (e) Associate Member (f) Senior Technician (g) Technician (h) Institutional Member (i) Donor Member.

Investigating the Critical properties of High Oleic Natural Esters with Nano-Composites

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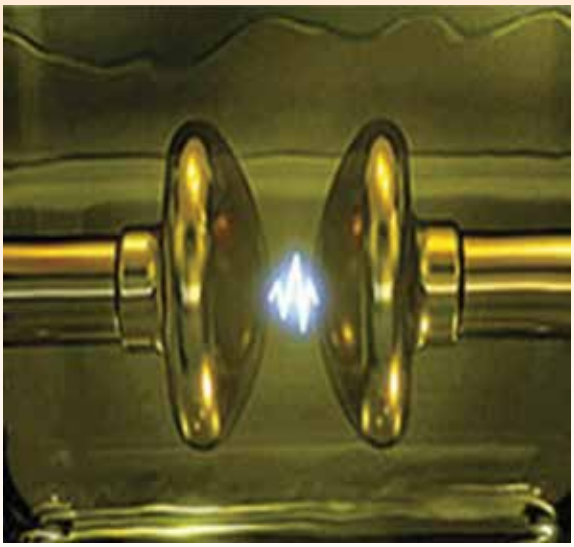
OBJECTIVES

For over one-hundred years, petroleum-based mineral oils have been used in liquid-filled transformers for insulation. The popularity of mineral transformer oil is due to availability and low cost, as well as being an excellent dielectric and cooling medium. The application of mineral oil in power system equipment like transformer is potentially hazardous to environment. The exploitation of petroleum oil is running out of demand and in the near future, oil scarcity exists. India is a tropical country, which produces vegetable oils like coconut oil, palm oil, pongamia pinnata oil, olive oil profusely and it can be used as dielectric fluids in transformer. To be more proficient in the operation of transformer, these vegetable oils should be converted into superior dielectric fluids. With the development of new insulation materials, vegetable oil, the best substitute for mineral oil has gradually been widely used in the liquid insulation of transformers. In liquid-filled transformers, the insulating liquid plays two important functions by providing the electrical insulation (in combination with a solid such as cellulose) and removing the heat generated by the windings. This project is proposed to analyze the performance of natural ester with antioxidants. We can find suitable oil for improving the critical parameters of insulating fluid. Moreover, vegetable oil could be an appropriated response to environmental, safety and health problems, and could reduce the exploitation and end-life costs of transformers. Based on the test results obtained, an economic solution is obtained and a recommendation is imparted to replace mineral oil with vegetable oil. The interpolation functions are calculated based on the results obtained in minimum and maximum concentration of antioxidant added.



Gap electrodes in Breakdown Voltage Tester

Experimental setup for measuring the Flash and Fire Point

ACHIEVEMENTS

High Oleic Natural Esters with Nano-Composites could be an appropriate response to environmental, safety and health problems, and could reduce the exploitation and end-life costs of transformers. Based on the test results obtained, an economic solution has been obtained and a recommendation is imparted to replace transformer oil with high Oleic oil with Nano-Composites. Dielectric properties of vegetable oils, mineral oil was investigated and compared. The property of vegetable oil was investigated against standards, and the results shows that the vegetable oil has a very good potential to be used as a dielectric fluid. The added advantages of vegetable oils in electrical equipment are that they have good biodegradability, which is well suited to vegetable oil as an organic natural ester. Hence the development and usage of dielectric fluid from vegetable oil base could ensure compliant to environmental and safety laws.

Research Fellowship Programme
The Institution of Engineers (India): R&D Grant-in-aid Scheme

The Institution of Engineers (India) supports research scholars from government & self-supporting engineering and technical institutions, pursuing full time M. Tech/PhD courses, in the form of fellowship under R&D Grant-in-aid scheme. The salient features are as follows:

- Proposals from Members and Institutional Members will be preferred. It is expected that the applicant's Institution is an Institutional Member of The Institution of Engineers (India). The Guide/s must be a Corporate Member of IEI. For details please visit www.ieindia.org. The student should apply for Corporate Membership (if not already a Corporate Member) once they becomes eligible to receive 'Fellowship' under IEI R&D Grant-in-Aid Scheme. Please see the checklist and guidelines of application for membership provided below, before proceeding with submission of proposal. IEI is authorized to make any exception to the above.
- The proposals should preferably be industry relevant and have in-kind or cash support from the industry partners or those having potential to lead to an entrepreneurship venture or a start-up model. Thematic focus on green energy, clean water, waste-to-energy conversion, versatile simulation, urban rejuvenation, skill development in design and manufacturing will be given due weightage.
- The quantum of fellowship is @ Rs 10,000/- per month usually for a period of 12 months extendable by six months subsequently for maximum two terms, subject to total duration not exceeding 24 months. Extension may be considered only on valid grounds and the decision of IEI will be final and binding.
- The entire amount will be transferred to the account of Principal/Director/Registrar/Dean (R&D) of the concerned Institute/University who will be responsible for periodic release of the grant to the applicant on a monthly basis. IEI may like to withdraw the entire amount if monthly progress report, duly sealed and signed, is not received from the beneficiary.

Further details are available under the 'R&D' button of our website www.ieindia.org.

Image Encryption and Decryption for Real time Applications

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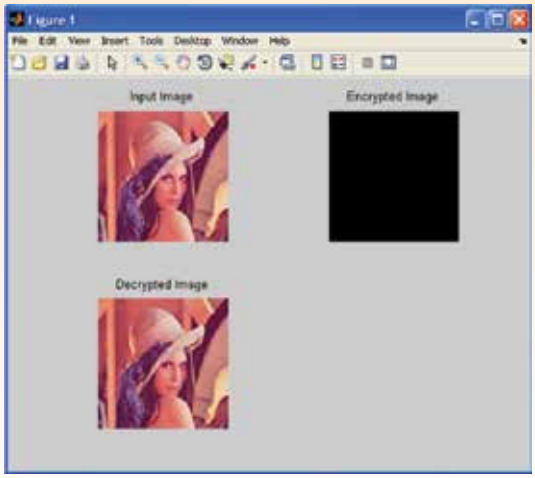
OBJECTIVES

The issues addressed in this research are possibilities to achieve efficiency measured in terms of level of security, compression rate and processing time, by using partial image encryption. The objectives of this research are as follows:

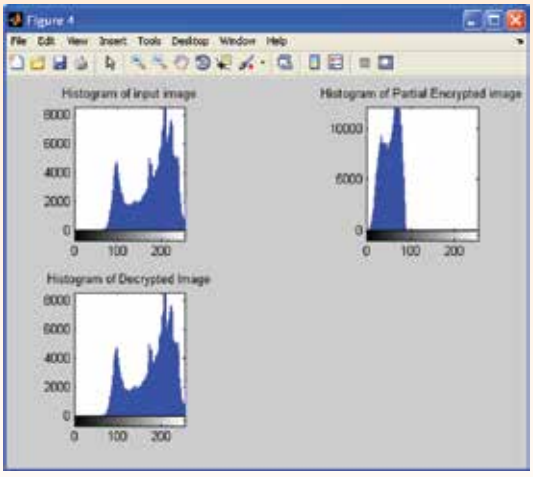
- To reduce the amount of data to encrypt while achieving a satisfactory and low-cost protection
- Image encryption applied in the field of secure information transmission and secured data storage
- The implementation of partial image encryption suitable for the real time applications like image encryption for medical, image encryption for satellite among others
- The development and performance of a unique partial image encryption based on the percentage of encryption

ACHIEVEMENTS

In this project work a quicker image encryption is proposed. Here we are implementing the partial image encryption using pixel scrambling technique to reduce the time required for encryption and decryption, this makes the encryption faster and reduces the time complexity. The security of this project work depends on pixel scrambling technique. Since there are many possibilities of pixel scrambling and random key generator, hackers will find it difficult to correctly guess all random strategies at the same time. Thus, the security is enhanced. The experimental results show that this method is effective to scramble the image and can provide high security.



Encryption and decryption of the input Lena image



Histograms of encryption and decryption of the input Lena image

Design and Development of Economically Affordable and Clinically Reliable Vein Finder

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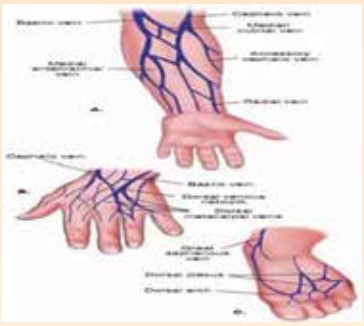
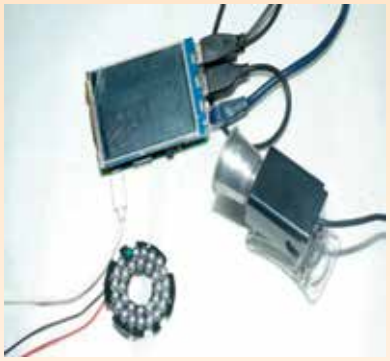
OBJECTIVES

To design a low cost and reliable vein finder to assist and aid phlebotomist, nurses during various vein puncturing procedures like phlebotomy and IV Infusion.

- To visualize antecubital vein and cephalic vein in forearm and dorsal hand in paediatrics, fat, dark and elderly people.
- To design multispectral IR illumination using NIR rays at four different wavelengths (740-780nm)
- To design IR sensitive detector using modified web camera.
- To integrate IR detector with Raspberry pi and to install driver software to stream the IR Detector.
- To interface the IR source, IR detector with LCD displays to make it as a portable and reliable device.
- To do clinical testing on various groups of people including fat, dark, paediatrics and elderly people.





Hardware and Experimental Setup

Results

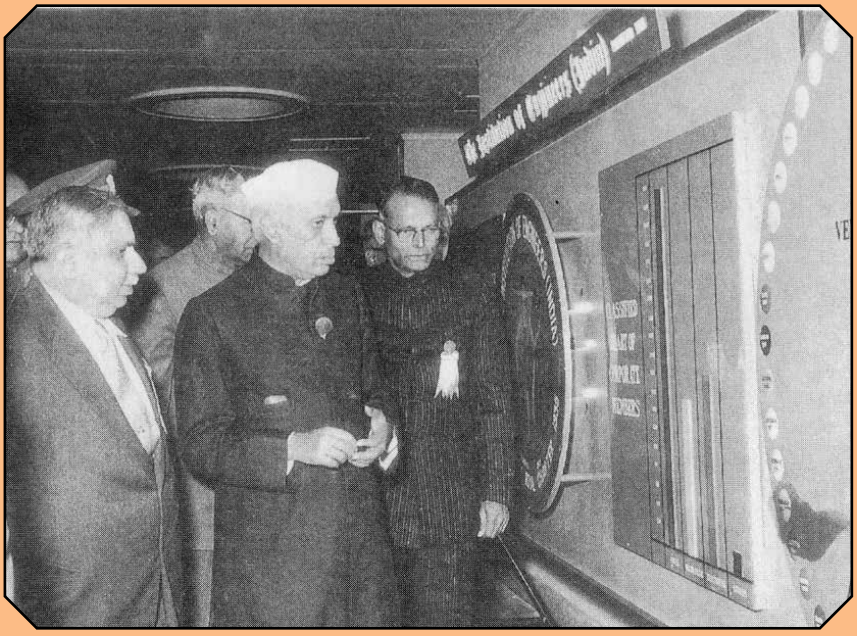
ACHIEVEMENTS

- The project has been granted a fund of Rs 50,000 by The Institution of Engineers (India).
- The product has been taken and clinically validated in different age group of patients in multispecialty hospital.
- The product has been recognised in the industry level in healthcare domain.
- The paper has been selected and published in the 30th Indian Engineering Congress (Make In India Pathway)proceedings and the ISBN no:978-81-931829-0-1.

PUBLICATIONS

- This project has been submitted as a PG thesis in the department of Biomedical Engineering in Rajalakshmi Engineering College, 2015.
- Fabrication of affordable and clinically reliable vein finder in the international conference ICON'2015 held at Nagercoil and the same has been published in the journal IJARTET.
- Economically affordable and clinically reliable vein finder has been published in the i-scholar journal.

Legacy of IEI



Pandit Jawaharlal Nehru, Prime Minister of India with Dr K L Rao, D P R Cassad at Delhi Centre

Performance Enhancement of Concrete Containing Fine Recycled Aggregate

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OBJECTIVE

- To study the effect of water cement ratio on the strength of recycled fine aggregate concrete.
- To study the effect of nano silica as strength enhancer in concrete containing recycled fine aggregate concrete.

EXPERIMENT PARAMETERS

- To study the compressive, flexural and tensile strength of normal strength concrete with recycled fine aggregate at 7 and 28 days.
- The water cement ratio is varied between 0.4 to 0.45, keeping a cement content of 400 kg/m³.
- The dose of nano silica for varies mixes are kept at 1 % of cement content.

Failed specimens after compression test

Apparatus for Chloride ingress test

Failed specimens after flexure test

Specimens under Chloride Ingress test

ACHIEVEMENTS

In this study, the effect of partial and full replacement of sand with recycled fine aggregate (Proportions from 0-100 %). By using nano silica as strength enhancer in concrete containing recycled fine aggregate. The dose of nano silica for various mixes is kept at 1% of cement content.

The following conclusions are made from the experimental study;

- The Hardened properties of concrete made with 20% and 30% of recycled fine aggregate are similar to those of concrete made with 100% of natural fine aggregate.
- The Hardened properties of concrete decreases gradually with respect to the increase of the percentage of recycled aggregates.
- When 1 % Nano - silica is used strength enhancement takes place so that RFA can be replaced upto 100% without affecting the hardened properties.
- By varying the w/c ratio in concrete, the hardened properties of concrete is higher in w/c ratio 0.4 compared to the w/c ratio 0.45.
- The SEM image shows very dense and improved Inter-facial Transition Zone.

PUBLICATIONS

"Strength Enhancement of Recycled Fine aggregate concrete using Nano-silica" to be presented in the International Conference REDECON-2016 at Bengaluru.

Legacy of IEI

His Excellency The President of India Dr Sarvepalli Radhakrishnan visited Hyderabad on 12th November, 1966 and unveiled the Statue of Bharat Ratna Sir Mokshagundam Visvesvaraya erected in AP State Centre on the Raj Bhavan Road, Hyderabad

Plastic Waste Management by Recycling of Polymer with Reinforcement of Metal Powder for Prototyping, Milling and Drilling Applications

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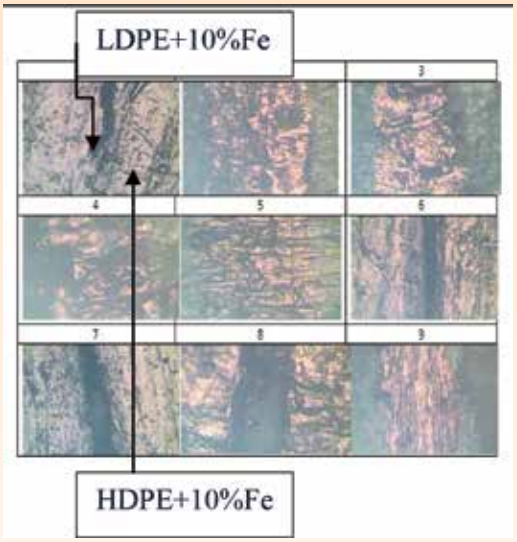
OBJECTIVES

1. To enhance reusability of plastic waste by reinforcement of metal powder for building of functional prototypes by using fused deposition modelling (FDM)
2. Dynamic mechanical analysis (DMA) of waste plastic based functional prototypes for engineering applications
3. To perform friction welding of dissimilar plastic waste material in drilling applications
4. To perform the parametric optimization of dissimilar plastic waste material using drilling set-up
5. To perform friction stir welding (FSW) of dissimilar plastic waste material for process development
6. To perform parametric optimization for FSW of dissimilar plastic based material using milling set-up for batch production activities

Melt flow tester



Optical micrographs for reinforced Fe metal powder joints at magnification of 100X

ACHIEVEMENTS

In the present work an effort has been made to use waste plastic with some reinforcement of metal powder for prototyping, drilling and milling application. A filament wire was prepared by taking two known material in powder form of which one is waste plastic (HDPE/LDPE) and the other is metal powder. Initially filament wire

was prepared by taking these two materials with single particle size i.e. the reinforcement which will be mixed is only of single size. After preparing wires, properties of filament wire like yield strength, ultimate tensile strength, %age elongation, Young's modulus were optimized and checked on the basis of MFI (melt flow index) i.e. wire was compared with the MFI of standard ABS filament wire. After that filament wire was prepared from batch production point of view. Once the filament trial was a success on commercial FDM setup (available at Institute), the products based on reinforced waste plastic were used for the DMA study.

In the second stage the developed filament was used for preparing the cylindrical surface (which acts like a drill for rapid tooling application) and parametric optimization for friction welding for dissimilar plastic based material with the modified drilling operation on Lathe was performed.

In the third stage two dissimilar plastic based specimens were studied for FSW application on the milling set up.

The outcome of this study is useful for reducing the plastic/polymer waste. The developed technology is in line with the Government of India initiative "Make In India" as this has lead to the in-house development of FDM wire filament.

PUBLICATIONS

- 02 Int. Jol. Publications (Elsevier, Composite Part-B, Engg. Thomson Reuters Impact factor 3.85),
- 03 Book chapters (Oxford: Elsevier) (01 published +02 accepted) are the academic outcome of this IE(I) sponsored project.

Legacy of IEI

Prime Minister Mrs Indira Gandhi cutting the Golden Jubilee Cake

Maximum Power Point Tracking of Solar photovoltaic System under Partial Shading Condition

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OBJECTIVE

In modern days, the application of solar energy has gained a lot of importance. India is a country which receives the solar radiation for almost 300 days a year. This advantage of photovoltaic (PV) can be used in rural areas to electrify the places which do not get reliable supply of electricity from the grid. The efficiency of a PV module is only 20% to 30% and per unit electricity cost is also high. The electrical characteristics of the PV array are nonlinear in nature and it has single maximum power point (MPP) under uniform irradiation condition. Partial shading is a condition where different modules of the array exposed to different irradiation. Due to partial shading on the PV array, the output power of the PV system gets reduced. Under partial shading condition the electrical characteristics of the PV panel modifies and resulted in multiple maximum power point. For maximum power extraction from the panel, it is necessary to operate the PV panel at its MPP. There are two types of techniques to extract the maximum power; one is by using different types of array configuration technique and another by using different types of MPPT (Maximum Power Point Tracking) techniques. The goal of this research is to extract maximum power from the PV array under partial shading condition.

ACHIEVEMENTS

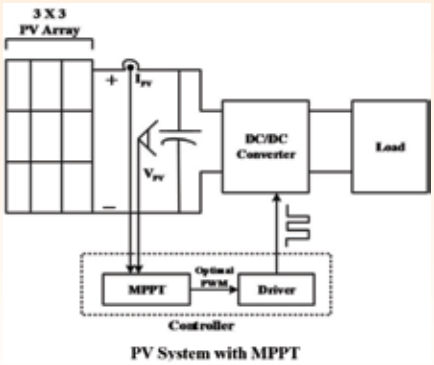
This study has reviewed various maximum power point tracking techniques to extract the maximum power output from the photovoltaic (PV) array under partial shading condition.

Due to the less efficiency of conventional PV array configurations, a new hybridized array reconfiguration technique has been proposed.

The customized boost converter 'that has been used for this project' is successful in giving the boosted output voltage by the help of the optimized control algorithm incorporated in it.

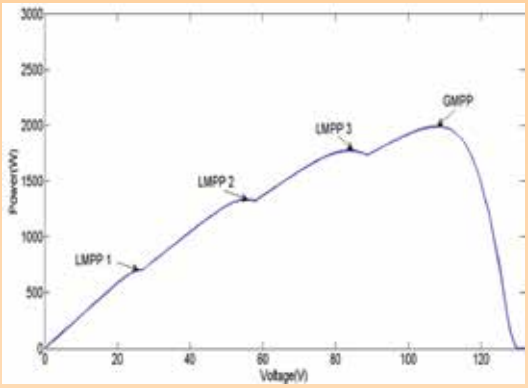
After connecting all the devices as shown in the diagram of the PV system, the following observations are being made:-

- The PV power rapidly fluctuates at every interval when subjected to shading.



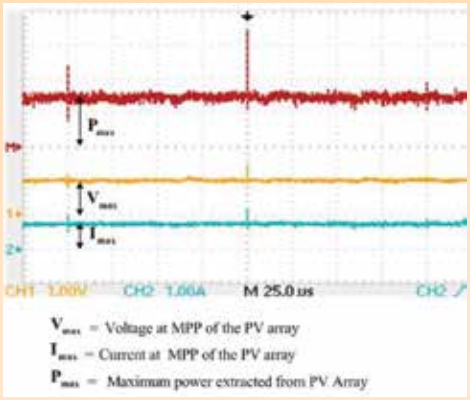
PV System with MPPT

Nine Solar panels connected together to form an array

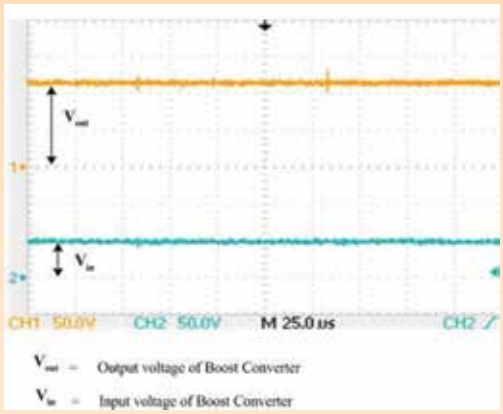


Power versus voltage curve of a PV array under shading condition

Hardware setup of the MPPT system



MPPT of PV array



Voltage waveforms of boost converter

- The conventional tracking technique i.e. Perturb and Observe method fails in partial shading condition.
- The new modern tracking technique i.e. Particle Swarm Optimization, which has been incorporated in this system, is quite successful in tracking the maximum power under partial shading condition.

It is seen that that the prototype of the proposed system has the ability to be used in inverter applications. The system has the ability to light up an entire room solely driven by solar power under any shading condition.

PUBLICATIONS

- Priti Das, Alivarani Mohapatra, Byamakesh Nayak, "Modeling and characteristic study of solar photovoltaic system under partial shading condition", International Conference on Solar Energy Photovoltaics-ICSEP, Materials Today Proceedings,Elsevier Publications, December 2016.
- Priti Das, Alivarani Mohapatra, Byamakesh Nayak, "Optimal Hybrid Array Configuration Scheme to Reduce Mismatch Losses of Photovoltaic System", Second IEEE International Conference on Electrical, Computer and Communication Technologies-ICECCT, February 2017.
- Alivarani Mohapatra, Byamakesh Nayak, Priti Das, K.B. Mohanty, "A review on MPPT techniques of PV system under partial shading condition", Renewable and Sustainable Energy Reviews, Vol-80, Page-854-867, Elsevier Publications.

Vibration and Damping Characteristics Woven Aloe Vera Fibre Fabric/Hybrid Polymer Uniform and Tapered Honeycomb Sandwich Composite Structures

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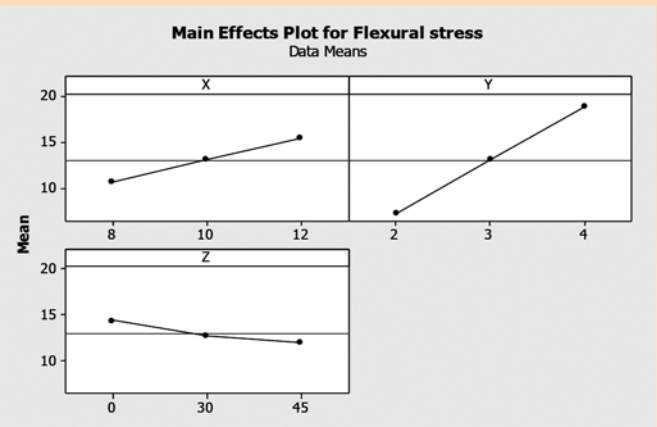
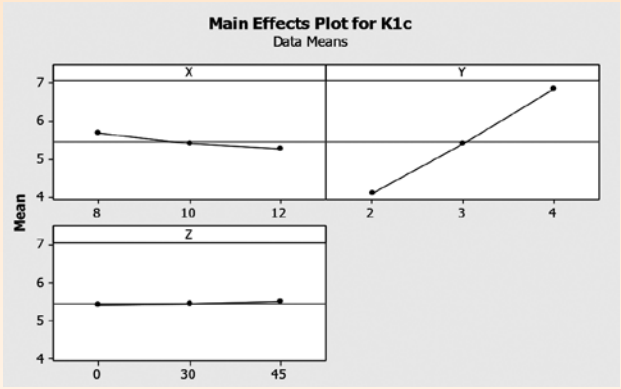
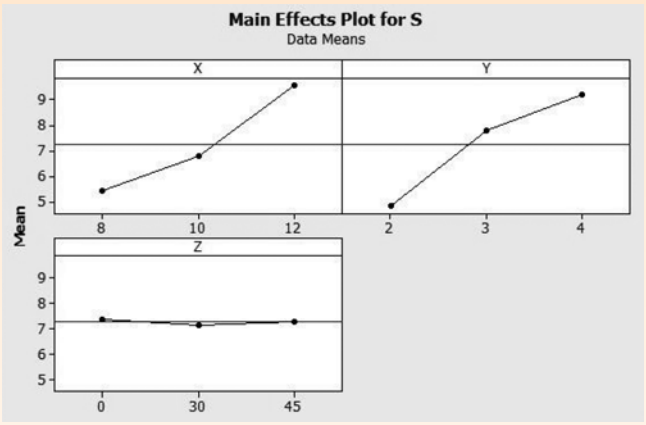
Poly-propylene honeycomb sandwich panel



Main effect plot for flexural analysis



Main effect plot for compressive analysis



Main effect plot for fracture analysis

OBJECTIVE

The overall goal of this research is to perform the flexural, compressive and fracture analysis and compare the experimental and analytical values of a sandwich panel with poly-propylene honeycomb as a core and jute reinforced epoxy matrix composite as skin layer. The specific objectives of this research are to:

- Fabricate the sandwich panel with poly-propylene honeycomb as a core and jute reinforced epoxy matrix composite as skin layer

- Compare the analytical and experimental values and evaluate the errors between analytical value and regression equation.

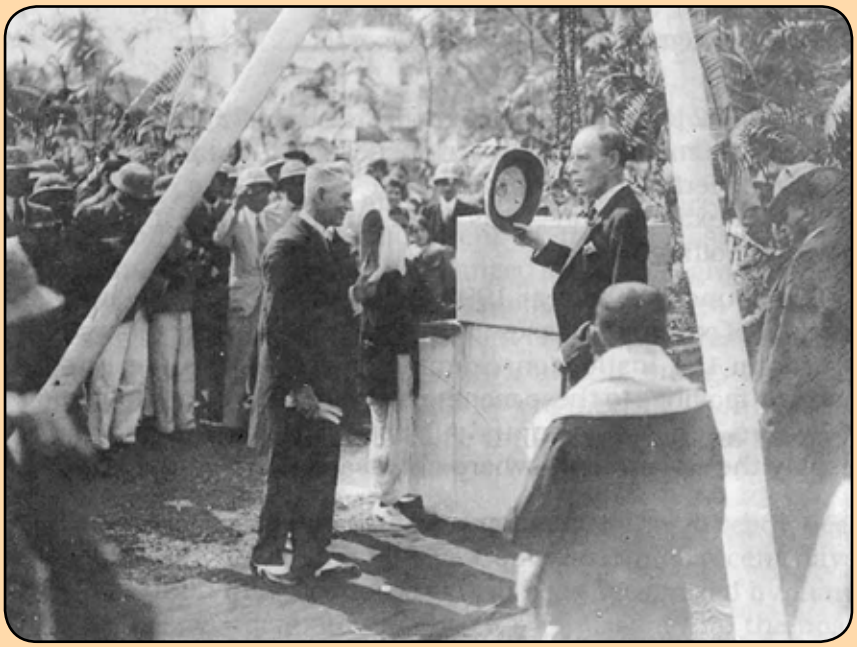
ACHIEVEMENTS

- Fabricated the sandwich panels with poly-propylene honeycomb as core and jute reinforced epoxy matrix composite as skin layer according to the ASTM standards.
- Compared the experimental and analytical values of sandwich panel and the error percentage obtained is less than 5%.
- Compared the analytical value regression equation and the error percentage obtained is less than 5%.

PUBLICATIONS

- The paper is submitted to Mechanics of composite materials journal.

Legacy of IEI



Lord Irwin, Viceroy and Governor General of India, laying the Foundation Stone of the First Institution Building in 1930

Automatic Diagnosis and Assessment of Lung Cancer Patients

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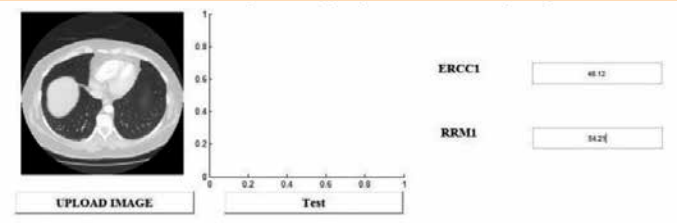
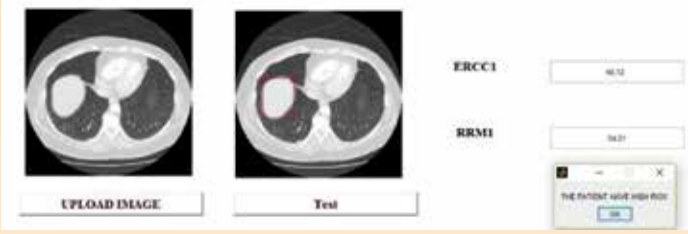


Input data



Output data

OBJECTIVE

The objective of the project is to predict the risk of lung cancer patients from chest computed tomography and two genomic biomarker ERCCI and RRMI. The prognosis is done by analysing the tumor related image feature in CT scan of the patient and from the two genomic biomarkers.

PUBLICATION

submitted a paper entitled "Automatic Prognosis and assessment of lung cancer patients" in IET image processing.

Smart Brief

August 1 of every year is considered as the World Lung Cancer Day. Lung cancer persists to be one of the most regular cancers worldwide, claiming more lives every year than prostate, breast, and Colon cancers combined. It is calculated that lung cancer values for nearly one in five cancer deaths around the World. The American College of Chest Physicians (Commonly called as CHEST), alongside members of the Forum of International Respiratory Societies (FIRS), celebrates, commemorates, and supports those impacted by the lung cancer. FIRS join the grassroots efforts of the lung cancer association to raise awareness about the lung cancer and its global impact, generating an educational movement of learning lung cancer risks as well as early treatment globally.

Evaluation of Tribological Properties on Ceiba Pentandra (Kapok) Seed Oil as an Alternative Lubricant for Machining Applications

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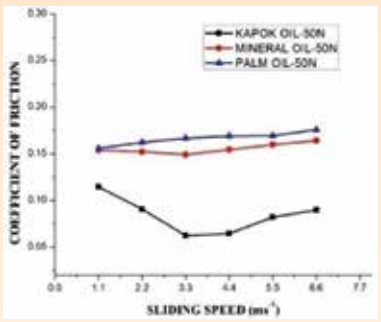
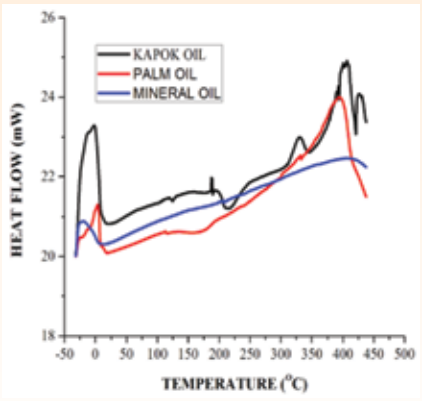
OBJECTIVE

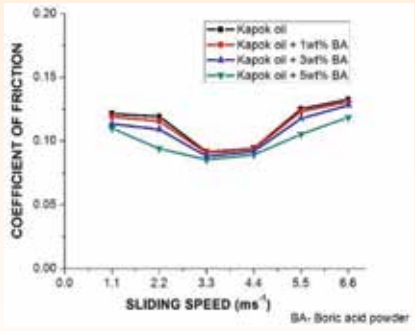
The decrease in availability of mineral oils and their environmental hazards created the need to search for the alternate bio-based oils. The aim of this study is to investigate the friction and wear characteristics of kapok (Ceiba pentandra) oil as bio-lubricant using pin-on-disk tribometer under different loads of 50N and 150N various sliding speeds respectively. The test is carried out an one hour operation time at room temperature. Also, the obtained results were compared with the palm oil and mineral oil (SAE20W 40). The test is repeated with the mixture of 1, 3, 5wt% of boric acid with the kapok oil. This mixture reduces the friction and wear rate considerably. Further, from the analysis, it is found that the coefficient of friction varies proportionally and wear rate varies inversely with the sliding speed as expected.

Further, in this work an effort was made to machine the Mild Steel (AISI 1020) steel using keyway milling process by analysing the surface roughness, and flank wear of the tool and Tool Condition Monitoring system is designed based on the acoustic emission and vibration signatures while using kapok oil as an cutting fluid. The





Kapok Seed and Oil Properties



Tribological Study Results

experiments are carried out based on the Response Surface Methodology Central Composite Design, Design of Experiments. The statistical parameters significantly increase for dull tool. The result shows that the extracted features increases consecutively with increase in flank wear. The present results confirm that the kapok oil can be used as an alternative lubricant to reduce the demand for mineral based oil lubricants.

ACHIEVEMENTS

In this work, a detailed study on the tribological properties of kapok (Ceiba Pentandra) oil as a bio-lubricant using pin-on-disk tribometer under different loads and rotating speeds were performed. Further, the kapok oil was used as a cutting fluid for milling operation and their vibration and cutting force were determined. The result shows that both coefficient of friction and wear rate were higher for 150N than the 50N applied load for all the lubricants at different sliding speeds respectively. The coefficient of friction and wear rate for the specimen lubricated with kapok oil showed lower value than the mineral oil and palm oil. From the surface texture analysis, it was found that there exists abrasive wear for kapok oil and palm oil lubrication. For mineral oil lubrication, mild adhesive wear exists. The kapok oil with the higher percentage of oleic acid possess the low coefficient of friction and wear rate, because the oleic acid forms the oxide monolayer over the surface that reduces the asperity contact between sliding surfaces. The wear rate decreases with the increase in sliding speeds for all the lubricants. This is due to the increase in temperature which forms an oxide layer at higher sliding speeds that protect from wear. Both wear rate and coefficient of friction decreases with the addition of boric acid powder with kapok oil. 5wt% boric acid provides the optimal result compared to the other combinations. The optimal process parameter for flank wear and surface roughness were found i.e. spindle speed of 647 rpm, feed rate of 0.09 mm/rev and depth of cut of 1.20 mm while using kapok oil as cutting fluid. It is clear that the feed rate had the most physical significance for the flank wear and surface roughness. The measured vibration and sound signatures show that the increase in wear leads to increase in the resultant vibration and sound pressure.

PUBLICATIONS

1. Shankar, S. Manikandan, M. and Raja G., 2017. Evaluation of tribological properties on ceiba pentandra (kapok) seed oil as an alternative lubricant. Industrial Lubrication and Tribology, (Under Review).
2. Shankar, S. Manikandan, M. and Raja G., 2017. Experimental investigation of vibration and acoustics signals in milling process using kapok oil as cutting fluid. Tribology in Industry, (Under Review).
3. Shankar, S. Manikandan, M. and Raja G., 2017. Experimental analysis of tribological properties of lubricating oil (ceiba pentandra) with boric acid as additives. Particulate Science and Technology, (Under Review).

Smart Brief

Since the 1990s, new areas of tribology have emerged, including the nano tribology, bio tribology and green tribology. These areas study the friction, wear and lubrication properties at nano-scale, in bio medical applications (human joint prosthetics, dental implants) and ecological aspects involved in study of tribology of clean energy sources, green lubricants and biomimetic tribology.

Solar Powered Street Sweeping Mechanism for Clean India

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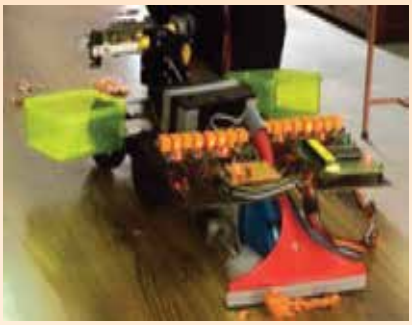
OBJECTIVES

- To design and implement an environment friendly sweeping system for providing public service, by providing cost effective and comfort handling
- To remove the small particles which are known to carry a substantial portion of the storm water pollutant load
- To design a less complicated and more cost effective mechanism than the mechanical belt and broom setup
- To protect the environment from dust particles
- To reduce of broomsticks usage by the street sweepers

Prototype setup of sweeper mechanism



Hardware snap during demo

ACHIEVEMENTS

- An environment friendly sweeping mechanism is made for providing public service
- The proposed system based on PIC microcontroller is found to be more compact, user friendly and less complex, which can readily be used in order to perform several tedious and repetitive tasks.
- Though it is designed keeping in mind the need for industry, it can be extended for other purposes such as commercial & research applications. Due to the probability of high technology (PIC microcontroller) used this "SOLAR POWERED STREET SWEEPING MECHANISM FOR CLEAN INDIA" system is fully software controlled with less hardware circuit.
- The proposed system has a unique performance compared to existing sweeper mechanism.

PUBLICATIONS

INTERNATIONAL JOURNAL

G.Ganesan@Subramanian, V.Mohan, S.Sivamani, G.Sundaravadivel, "Solar Powered street sweeper mechanism for clean India", International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Page: 11-15; Volume-5 Issue-6, January 2017.

Performance Investigation of Green Wireless Systems

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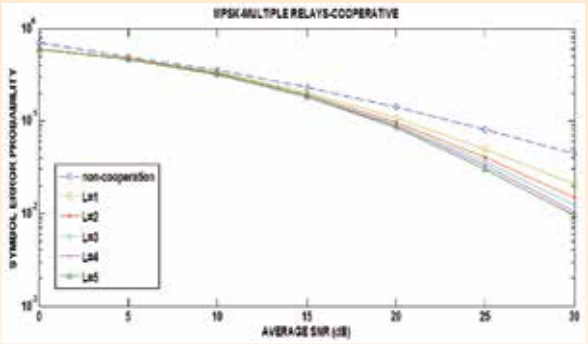
OBJECTIVES

The main objectives of the project are

1. To focus on achieving 'Green' reliable communications using relay structures by comparing the performance of entire cooperative relay structures with the conventionally existing techniques
2. To design a cooperative wireless network by creating a virtual MIMO systems and analyze its error performance in terms of symbol error probability
3. To develop an algorithm which enhances the performance of a wireless systems.

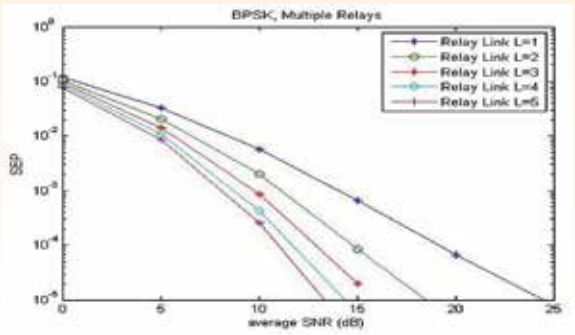
ACHIEVEMENTS

This project has shown the possible benefits of a wireless transmission using cooperative diversity to increase the performance. The diversity is realized by building an ad-hoc network using a third station as a relay. The data is sent directly from the base to the mobile or via the relay station. Such a system has been simulated to see the performance of different diversity protocols and various combining methods. The AAF protocol has shown a better performance than the DAF protocol irrespective of the combining method used at the receiver. But it must be considered that no error correcting code was added to the transferred signal. Therefore, it was



SEP of MPSK multiple relays using conventional selection combining

Performance analysis for multiple relays using proposed scheme



not possible to take full advantage of the DAF protocol. To get an idea of the potential of the DAF protocol the magic genie was introduced to simulate an error correcting code. The performance of a system using the DAF protocol in combination with a magic genie was much better than one using the AAF protocol. The choice of combining method has a big erect on the error rate at the receiver. When AAF is used at the relay station the easy to implement Equal Ratio Combining (ERC) shows some benefits compared to the single link transmission. If possible the Fixed Ratio Combining (FRC) should be used. This only need knowledge of the average channel quality, and shows a much better performance than the ERC. If knowledge of the current state of the channel quality is available more sophisticated combining methods can be used. The Enhanced Signal-to-Noise Ratio Combining (ESNRC) has shown a very good performance considering that a rough approximation of the channel quality is sufficient.

The location of the relay is crucial to the performance. The best performance was achieved when the relay is at equal distance from the sender and the destination or slightly closer to the former. In general the relay should not be too far from the line between the two stations.

PUBLICATION

"Presenting Explorations of Cooperative Green Systems", Proceedings of the International Conference on current innovations and Technology, on 4.10.2015,at Chennai(ISBN:978-1514782).

Legacy of IEI

Prime Minister Indira Gandhi being received at the 12th World Energy Conference

ISTAR- Intelligent Solar Tracker with a Compressorless Refrigerator

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OBJECTIVES

Solar energy is an indigenous, inexhaustible and clean source of energy that can be tapped in numerous ways to be used to satisfy present energy needs. With about 300 clear sunny days in year, India has a huge potential to reap maximum benefits out of this abundant resource. As per studies, nearly 75% of the energy is lost in the morning and evening hours with fixed mounted solar PV cells, due to the daily east to west transition of Sun. Furthermore, about 8.3% of energy is lost with a single axis tracker, since it is incapable of tracking the seasonal movement of the sun. The main objectives of the project are

1. Design and fabrication of an intelligent self-sustainable dual axis solar tracking unit to tap maximum solar energy, thereby improving the efficiency of the solar photovoltaic system. A solar tracker that accounts for both the daily and seasonal motions is known as a dual-axis tracker. The microcontroller-based solar panel tracking system is proposed in this project work. It is azimuth-altitude dual axis tracker (AADAT)
2. To develop an eco-friendly compressor-less refrigerator based on Peltier effect as an application of solar photovoltaic using dual axis solar tracking system.

Customised Gear Arrangement

Back View of Project

Front View of Project

Project on Display

ACHIEVEMENTS

A prototype dual-axis solar tracking system based on a microcontroller is designed and developed. This auto-tracking system is controlled with two 12V, 17W DC gear box motors. The four light sensors (photodiodes) are used to track the sun and to start the operation. The orientation system calculations are based on astronomical data. The system is designed to control the Altitude angle in the vertical plane as well as the Azimuth angle in the horizontal plane of the photovoltaic panel workspace. The open circuit voltage and power outputs of solar photovoltaic (PV) system were measured for fixed tilt type position and dual-axis solar tracker for different timings of the day. The results show that performance of solar PV with dual axis system is better. The proposed design is expected to enhance output of solar photovoltaic system by 15-20% by keeping the panel's face perpendicular to the sun. The system is assumed to be valid for any region with small modifications. The output of solar PV system is utilized in developing compressorless refrigerator. It is a thermoelectric refrigerator based on peltier effect. The advantages of thermo-electric refrigeration are (i) simple, (ii) noiseless, (iii) compact & light weight, (iv) eco-friendly since no refrigerants are used,(v) more reliable than systems with moving parts, and (vi) easy control by varying current.

Every specific application where a thermoelectric cooler module or refrigerator is required is characterized by a set of operation parameters, which dictate the necessity and accurate selection of the optional thermoelectric cooler type among a wide range of single and multi-stage thermoelectric cooler modules.

These parameters are:

ΔT– Operating temperature difference

Q_c – Operating cooling capacity

I – Applied or available current

V – Terminal voltage

A prototype thermoelectric refrigerator is developed. The project can used an off-grid portable cooler or warming chamber especially for carrying medicines, foods etc. It can be used as a standalone power system in remote areas.

Experimental Exploration on Low Cycle Fatigue Behaviour of ZrC Nanoparticle Reinforced with Cu-Cr Matrix Composites Prepared by Stir Casting

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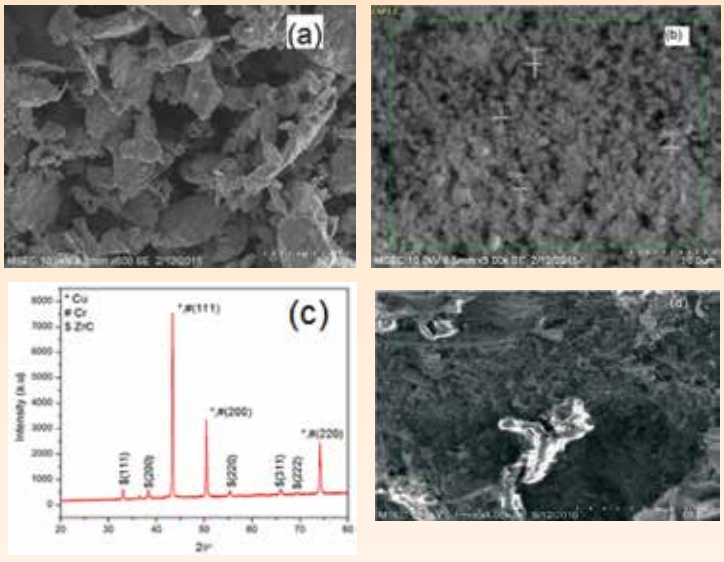
OBJECTIVES

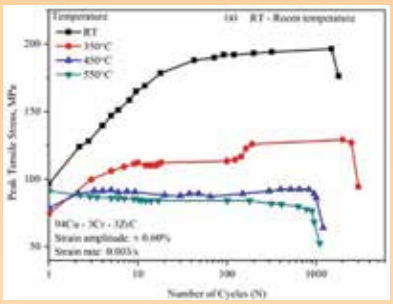
- Synthesized the nano particle (ZrC) by using a mechanical milling
- Fabrication of Cu-3Cr-3ZrC composite through liquid metallurgy route
- The die samples were cut into required size and machined to required shape for LCF testing
- The test was conducted at different strain amplitude and temperature at constant strain rate
- Characterized the mechanical properties of the newly developed Cu-Cr based nanocomposite
- Investigated the effect of tensile strength, hardness and low cycle fatigue behavior of Cu-3Cr-3ZrC nanocomposite.

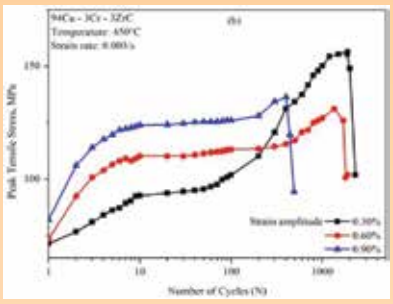
ACHIEVEMENTS

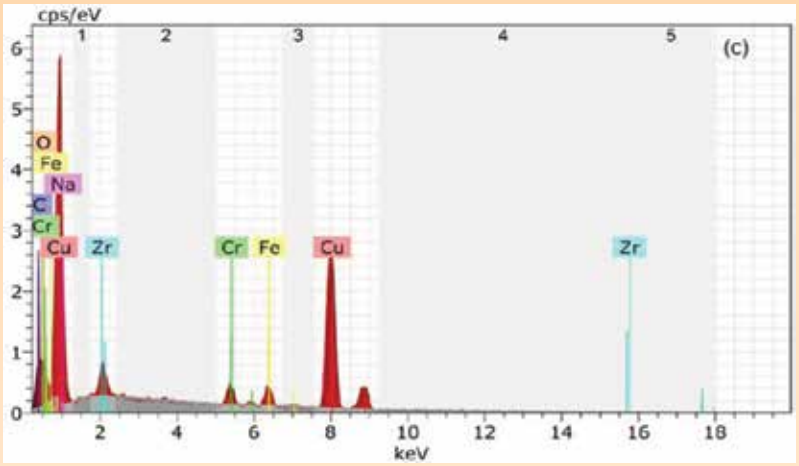
- The powders are homogenously mixed in casting furnace for the required temperature and the molten metal was poured in a required shape of die.
- The samples were cut into required size and machined to the required shape for LCF testing.
- Photo 1 (a) shows the SEM micrograph of the Cr particle; it is in the development of crushed needles and large flakes like particles and also Photo 1 (b) shows the SEM micrograph of the ZrC powder. The particles have hexagonal and cubic structure. X-ray diffraction (XRD) analysis of the cast composite is shown in Photo 1(c). Cu, Cr and ZrC peaks were indexed using JCPDS files (file numbers 851326, 882323, and 654932 respectively). XRD analysis showed in Photo 1(c) confirms the presence of ZrC in the matrix. These results specify the existence of Cu and Cr (in the major peaks), and ZrC is indicated by minor peaks.

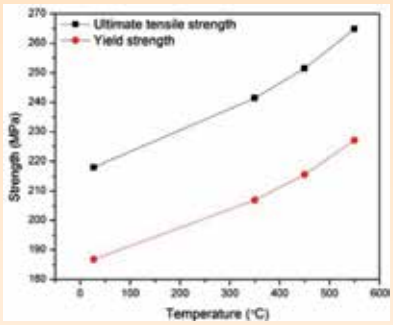


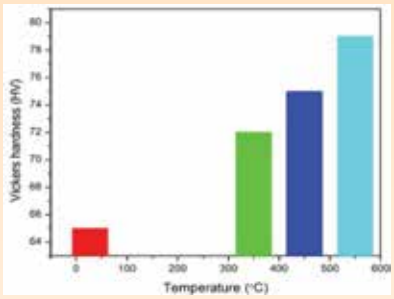
SEM micrograph of (a) Cr powder, (b) Zirconium carbide powder (c) XRD analysis of Cu -3Cr-3ZrC nanocomposite after casting (d) SEM micrograph of extended dislocations and dislocation angles formed during LCF cycling at ±0.30 %, 450°C.











- Photo 1 (d) the SEM image were taken after LCF cycling (±0.30%, 350oC), was shown in Photo 1 (d). These particles are believed to have imparted a strengthening effect, giving rise to the observed secondary hardening.
- The Cu-3Cr-3ZrC nanocomposite did not show a secondary hardening regime at temperatures below 350oC and higher than 550oC as shown in photo 2 (a). The perceived secondary hardening may then be ascribed to the fine precipitates formed during the cyclic deformation. It may be revealed that such a fine precipitate distribution was not perceived in the solution annealed condition.
- The annealed, precipitate free microstructure prevalent at the start of cyclic deformation incessantly changes during cyclic loading. It may be perceived from photo 2 (a) that the fatigue life shown by the alloy at 350oC was almost identical to that obtained at room temperature. This could be ascribed to the precipitation coupled with secondary hardening perceived at the above temperature. The fine, uniformly distributed precipitate particles interact strongly with mobile dislocations, thus leading to significant enhancement in the LCF life.

- The range of hardening was seen to be extra prominent at the lower most applied strain amplitude of ±0.30% as reflect in photo 2 (b). With reference to photo 2 (b), it can also be observed that the range of secondary hardening gradually dropped with an increase in the applied strain amplitude.
- Photo 2(c) shows the EDS spectrum that specifies the presence of Cu, Cr, Zr and C content in the tested specimen.
- To enhance strength of the composite, the reinforcement plays an important role together with an increase in hardness of Cu–3Cr–3ZrC nanocomposite. With a view to assess the role of subsequent thermal ageing on the LCF behaviour, a series of test buttons were subjected to stress-free thermal ageing treatments at different temperatures for different durations. The strength was measured after each ageing treatment and the variation of strength with ageing temperature is presented in photo 2(d). As seen, the strength was increase with ageing temperature this is due to the increase in hardness, thermal aging and the grain refinement of the composite.
- The Vickers hardness (using a load of 49N) was measured after each ageing treatment and the variation of hardness with ageing temperature is presented in photo 2(e). As seen, the hardness increases with ageing temperature and this is due to the thermal aging and the grain refinement of the composite.

Legacy of IEI

Dr Shankar Dayal Sharma, Hon'ble President of India, lighting the lamp to mark the inauguration of the Platinum Jubilee of IEI on December 17, 1994, in presence of HE Governor of West Bengal Shri K V Raghunatha Reddy and Shri Jyoti Basu,Chief Minister of West Bengal

Design & Construction of A Multiutility Air Cushion Vehicle

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OBJECTIVES

- To design and build Hover craft more efficiently and to analyse the potential capabilities of designing and building hovercrafts
- To identify potential research areas related to hovercraft technology and implement upon completion of the project
- To introduce an energy-efficient way of travelling and search for other utilities of implementing this technology
- To make a cost effective & environment friendly Rescue vehicle to meet emergency situation in any sort of terrain
- To add more technological features especially for rescue oriented purposes.

CATIA models of the product

Stages of development

ACHIEVEMENTS

The stability of the hovercraft is increased. It shows that the air is getting distributed equally under the skirt. There is lesser chance of capsizing. The hovercraft moves on the tile with very less effort. When tested on tarmac, it is seen that lesser amount of force is required as compared to the above result. This shows that the friction is significantly reduced as the physical contact between the skirt and the ground is reduced due to increased pressure under the craft. This achieved by using the more powerful blower. The amount of air loss under the skirt can be neglected. This is because the amount of air expelled under the craft is much greater than that which escapes under the craft. This allows the craft to hover a few inches above the ground. The thrust engine produce enough force to move the hovercraft forward. The blades are designed such a way that the pitch angle is variable. This allows us to place the blades in the optimum angle to get maximum thrust.

Development of Anti Snake Venom Drug From Moringa Oleifera (Bengali: Shojne Danta, Hindi: Sahjan)

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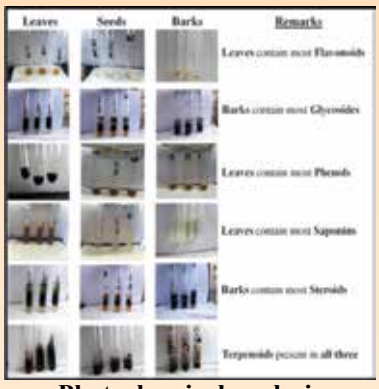
OBJECTIVES

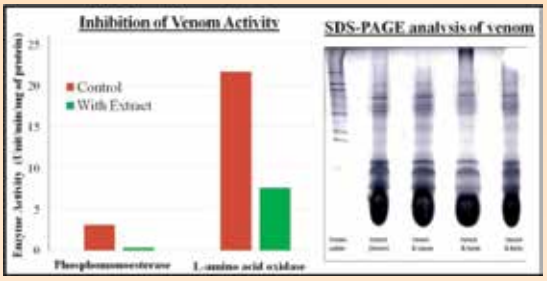
i) To find out the metabolites present in the different parts of Moringa oleifera

ii) To study the deactivation of venom activity

iii) To check the protein alteration of venom in presence of metabolites by SDS-PAGE.



Phytochemical analysis



Enzyme inhibition study and protein degradation study

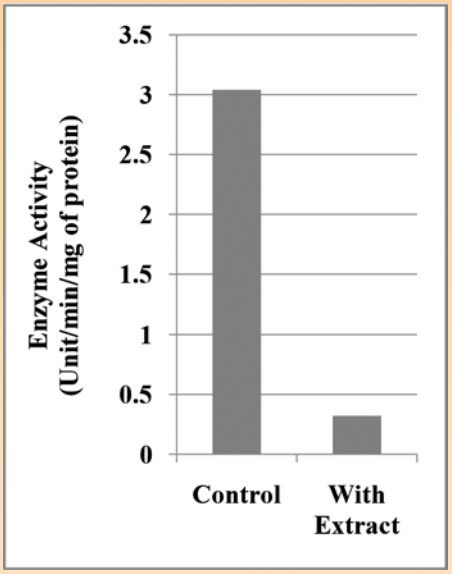
ACHIEVEMENTS

Outcome of metabolites present in the parts of Moringa oleifera i.e., barks, seeds and leaves, which is mentioned in the Table-1:

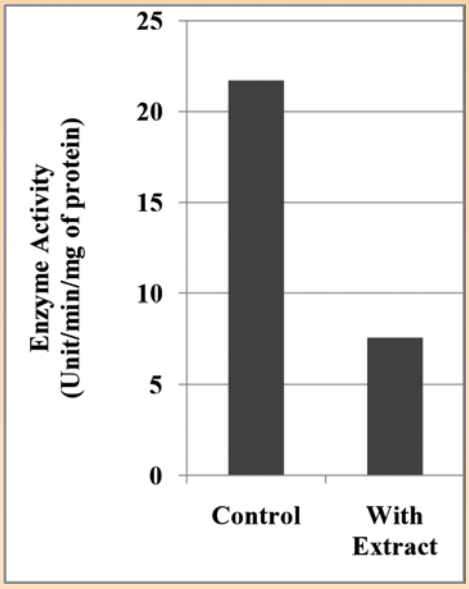
Name of the Metabolite	Barks	Leaves	Seeds
Alkaloids (Hot and Cold)	-	+	+++
Phenols (Hot and Cold)	-	+++	-
Saponin (Hot and Cold)	+	+++	+
Flavonoids (Hot and Cold)	-	+++	+
Glycosides	+++	+	++
Steroids	+++	-	+
Terpenoids	+++	+++	+++
(+++ = Most, ++ = Medium, + = Least, - = not Present):			

Table 1: Phytochemical Analysis

From this experiment, we have considered leaves extract for checking the enzyme activity.



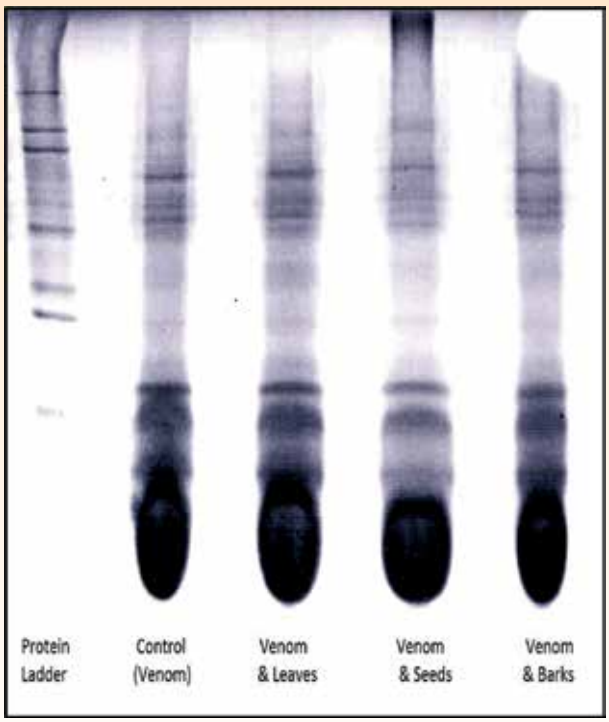
Activity of phosphomonoesterase



Activity of phosphomonoesterase

Our observation is interesting which reflects that the enzyme activity (phosphomonoesterase, L-Amino acid oxidase) was inhibited by the leaves extract.

Analysis of SDS-PAGE of Venom in presence of extracts



SDS-PAGE of Venom

The result indicates there is no degradation observed in venom, in the presence of three different extract namely Leaves, Seeds, and Barks.

Taking into account the data obtained from the SDS PAGE gel of the sample (venom + extracts), it is clear that there is no protein degradation caused by the metabolites. Yet, as there is conclusive proof that the activity of certain enzymes present as a component of the snake venom has decreased, it must mean that the metabolites bind to the active site of the enzyme and display the competitive inhibition behaviour. Many of the pharmacological effects of the venom are caused due to the aggregate activity of various enzymes present in the snake venom, some of which are L-amino acid oxidase and phosphomonoesterase. Also, it could be possible that there are various other metabolites in the plants apart from the ones that are included in the subject of our study. But it has been seen till now that leaves are the best source of metabolites.

PUBLICATIONS

The abstract of this work has been published in proceeding of the following conference along with Poster Presentation on 21st May, 2016.

Poster Presentation by Debayan Bhattacharya, Avi Agarwal, Ruchita Bhattacharjee, Dijendra Nath Roy; A pilot study on anti-snake venom potential of moringa oleifera (Bengali: Shojne danta, hindi: Sahjan), in National Conference on Recent Development and application in Chemical Science, organized by Department of Chemistry, National Institute of Technology Agartala during 20-21 April, 2016.

Legacy of IEI

Laying of Foundation Stone of IEI Headquarters Building by Shri Profulla Chandra Sen, Chief Minister of West Bengal in 1963

Eyeball Sensor in Automatic Wheel Chair for Paralysed Patients

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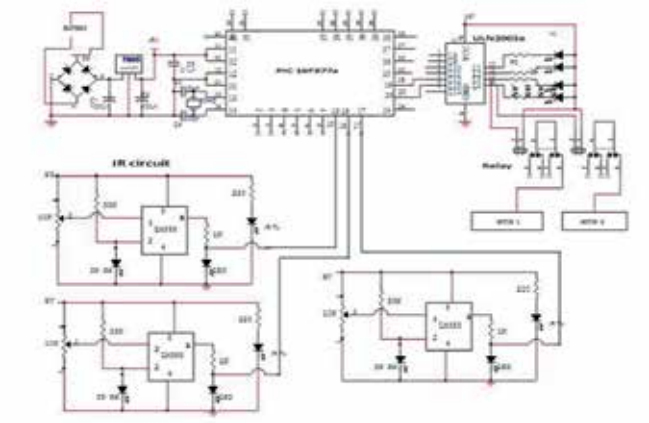
OBJECTIVES

This project follows a new method to guide and control the wheelchair for disabled people based on their eyeball movement. In this method, sensor based eyeball tracking system is used to control powered wheelchair. Eyeball sensor will generate distinct range of values for each position of eyeball (i.e. left, right, straight, reverse). The obstacles can be determined and avoided by using camera and ultrasonic sensor. This concept can be used for multiple applications, but this project focuses the application to mobile and communication aid for paralytic people. The proposed system involves two stages; first eyeball tracking and second sending control signals to the powered wheelchair.



Overall Experimental circuit diagram

Testing Methods

ACHIEVEMENTS

The movement of eyeball has been precisely sensed by the eye ball sensor. The sensed values have been utilized successfully to control the movement of wheel chair automatically. This system consists of eyeball sensor, micro- controller and wheelchair. The above mentioned hardware along with the software proved to be great tool which makes the life of the paralytic people independent. It is concluded that the proposed key-in system with human eyes only works 100% perfectly for the number of keys is four, start, stop, turn right and left. Also it is concluded that the proposed EWC control system does work in a real basis avoiding obstacles on range bellow 3.4 m using image processing method and bellow 3 m using ultrasonic sensor. By the proposed system, EWC is able to identify obstacle and avoid them. Obstacle avoidance can assist user although undesired condition such as dark areas, glass wall or door, smoke area, etc can provide hindrance. By implementing this system, it is found that EWC can move more safely and comfortably.

Air Cooling System in Car using Solar Energy

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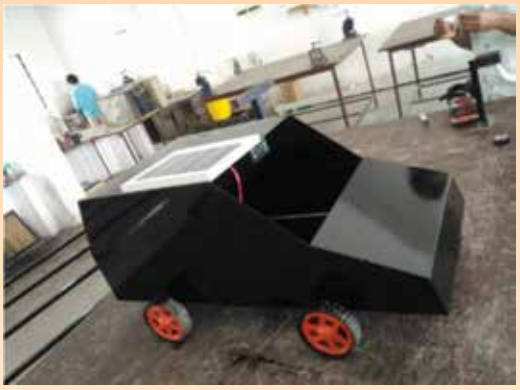
OBJECTIVES

To reduce the inner temperature of the car while it is parked in an open space, with the use of Renewable Solar Energy. Solar panel of 12V, 6watts generates current when it is exposed to a temperature of 298K. The generated current is used to run the blower (cooling fan) of 12V to remove the hot air inside the car.

To remove the heat generated due to the vehicle parked in an open hot sun light. The temperature range inside the car is kept by the proposed method at 27°C - 33°C. Hence, through the method of proposed work the discomfort to the occupants can be minimized.



View of the project

Project with students and Guide

ACHIEVEMENTS

The aim of this project work is mainly to increase the sophistication inside the car parked under sunlight. The developed cooling system in car is equipped with solar panel, blower, temperature sensor, battery and voltage regulator. The temperature inside the car gets increased when it is parked under the open sunlight. It will increase the occupants discomfort while sitting inside the car. Solar energy is abundant in nature. Hence, making use of solar energy will be very useful in future to rectify this problem. It can be done by solar panel. A heat removal system that able to control and maintain temperature inside the car at the range of 25-30°C when parked under very hot condition. In Coimbatore, the average temperature during summer season is 32-34°C and during winter season the average temperature is 25-29°C. Hence, the temperature to be maintained in car is 27°C. This temperature will be acceptable in every region.

PUBLICATION

Sanjay Kumar. S, Syed Thameen. U, Vignesh. R, Subash. B & Dr. P. Tamilselvam presented a paper on "Air cooling system in car using solar energy" in International Conference on Mechanical and Building sciences conducted by SNS College of Technology during March 23-24, 2016.

Production of Biogas from Agro Industrial Wastes

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OBJECTIVES

The objective of the project work is to obtain large amount of methane in combination of agriculture waste such as sago, coffee pulp and poultry wastes in co-digestion with cow dung. The raw source is obtained from different places stored at different condition to obtain the maximum volume of methane from minimum raw material.

ACHIEVEMENTS

The project report suggests that the biogas production was achieved by using organic solid wastes such as sago, coffee pulp and poultry wastes in co-digestion with cow dung. The feed optimization for biogas production was carried out by using RSM tool.

The coffee pulp waste was collected from the coffee seed processing industry in Yercaud hill station, Salem, Tamil Nadu, India. Cow dung was collected from a dairy farm. The samples were scraped off the feed lanes and collected in a bucket. The samples were transported immediately to our laboratory and placed in the digesters. The maximum gas production 28l/kg was achieved by the mixture of cow dung (150kg) with coffee pulp (25.5 kg), sago waste (25.5kg) and poultry waste (50kg) during the incubation period of 17.5 days. The biogas with methane was confirmed by using GC-MS analysis.

Examining the bio gas plant

Refilling the Agro waste

Run	Cow dung (Kg)	Coffee pulp (Kg)	Sago waste (Kg)	Poultry waste (Kg)	Incubation day (Days)	Methane Yield (L/Kg)
1	75	25.5	1	25.5	17.5	14
2	75	25.5	25.5	50	17.5	15
3	75	50	25.5	25.5	17.5	13
4	75	1	25.5	25.5	17.5	14
5	75	25.5	50	25.5	17.5	14
6	75	25.5	25.5	1	17.5	13.5
7	75	25.5	25.5	25.5	5	7
8	75	25.5	25.5	25.5	30	14
9	112.5	50	1	25.5	17.5	16
10	112.5	1	50	25.5	17.5	15.5
11	112.5	50	25.5	50	17.5	23
12	112.5	1	25.5	25.5	5	10
13	112.5	25.5	1	50	17.5	20
14	112.5	25.5	25.5	1	30	15
15	112.5	25.5	25.5	25.5	17.5	23.5
16	112.5	25.5	25.5	25.5	17.5	23.5
17	112.5	25.5	50	25.5	30	16.7
18	112.5	25.5	25.5	25.5	17.5	23.5
19	112.5	25.5	25.5	25.5	17.5	23.5
20	112.5	25.5	1	1	17.5	19
21	112.5	50	25.5	1	17.5	21
22	112.5	25.5	50	25.5	5	11
23	112.5	25.5	25.5	50	5	11.5
24	112.5	1	25.5	25.5	30	16
25	112.5	1	1	25.5	17.5	20
26	112.5	25.5	25.5	1	5	11
27	112.5	25.5	25.5	50	30	16.8
28	112.5	1	25.5	50	17.5	22
29	112.5	25.5	25.5	25.5	17.5	23.5
30	112.5	25.5	25.5	25.5	17.5	23.5
31	112.5	50	25.5	25.5	5	10.5
32	112.5	25.5	1	25.5	5	11
33	150	25.5	1	25.5	17.5	25.8
34	150	50	25.5	25.5	17.5	30
35	150	25.5	50	25.5	17.5	27.5
36	150	25.5	25.5	1	17.5	26
37	150	25.5	25.5	50	17.5	28
38	150	25.5	25.5	25.5	5	16
39	150	1	25.5	25.5	17.5	23

Solar Powered Wheelchair Controlled by Voice Recognition System for Physically Disabled People

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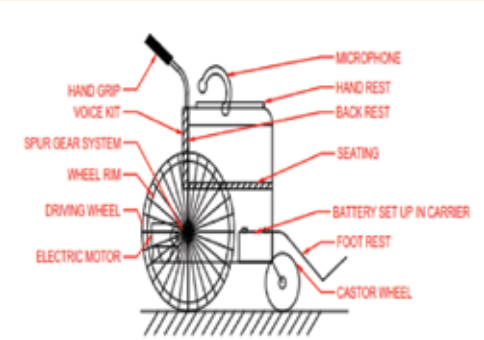
OBJECTIVES

The main objective of this project is to utilize solar power and implement voice control system in the design and development of wheelchair so that the physically disabled people in India can increase their self mobility on flat horizontal surfaces, both indoor and outdoor. Presently, manual wheelchairs are used by many of the disabled, but some current users of the manual wheelchairs do not have the physical strength or strong upper limbs. As such they need a companion to move the vehicle and are also not able to travel long distances. Thus in the present project work, a solar powered electric motor system and a motion control system consisting of voice recognition unit are added to the current manual wheelchair to provide wheelchair users with improved levels of self mobility. It will be eco-friendly and pollution free.

ACHIEVEMENTS

The main components of the proposed Solar Powered Wheelchair controlled by Voice Recognition System (Fig.1) include solar panel which absorbs the solar energy from the sun, battery which is a storage place for the energy received by the panel, charge controller which makes sure that the batteries are always fully charged and ready to go all the time, electric motors which receives the electrical energy from batteries and provides the motion, voice recognition system which automatically generates a closed captioning of conversations and commands the wheelchair to move according to user's will. The wheelchair proposed in this project can run at a maximum speed of about 6.33 Kmph and helps to enhance the mobility of the disabled.

The design aspect of the project mainly includes the calculation of the centre of gravity of the vehicle, maximum speed of the vehicle, check for static and dynamic balance of the wheelchair, and details of circuits and controls. Also the voice recognition system used in the project (HM2007) is trained with the voice commands FORWARD, BACKWARD, RIGHT, LEFT, and STOP. The program of microcontroller (Arduino) used in drive circuit of voice kit is developed using Arduino Software. The test run of the fabricated model (Fig.2) of the wheelchair concludes that the developed model is reliable, sustainable and functional.



Schematic of Solar powered wheel chair

Pictures of final Assembly of SPWCV

Sound Energy to useful Electrical Energy

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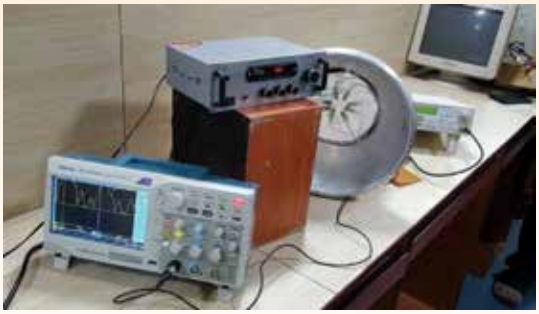
OBJECTIVES

Availability of energy resources, specifically non-renewable sources is getting harder day by day. In order to cope with the growing demands of the mass, various techniques has evolved which technically converts the renewable resources available to useful energy. The various renewable resources available are solar, wind, geothermal etc. Another such form of energy which is available to a great extent in the environment, but mostly gets wasted a way is SOUND. 'SOUND' is a source which engulfs every phase of life and environment, always goes wasted once produced. In this project we have discussed about a new power generation method which converts the sound energy that is available in the environment in to useful electrical energy using peizo materials commonly called the piezo electricity. Moreover, the final results obtained always contained the help from some external sources which normally included batteries. Here from the hardware part we have specifically tried to focus our concentration on the apparatus setup by using sound converging techniques, thereby trying to avail the maximum input energy. Also our preliminary objective was to omit the application of various power sources required to run the circuit as previously practiced there by obtaining the electrical output from the sound source itself resulting in better accuracy and efficiency.

ACHIEVEMENTS

1) Previously efforts have been made to convert the sound energy into useful electrical energy. But it was observed that the amount of energy generated was partially used to run the circuit which included op-amps. But in our work we have primarily focused not to use any other external power sources to run the circuit which is completely a different approach made towards this project.

2) The output obtained was the most optimal one because we have tried to keep the circuit as simple as possible. Even the diodes used for making the rectifier circuit were schottky diodes because the voltage



Piezo vibration censor arrangement on the membrane

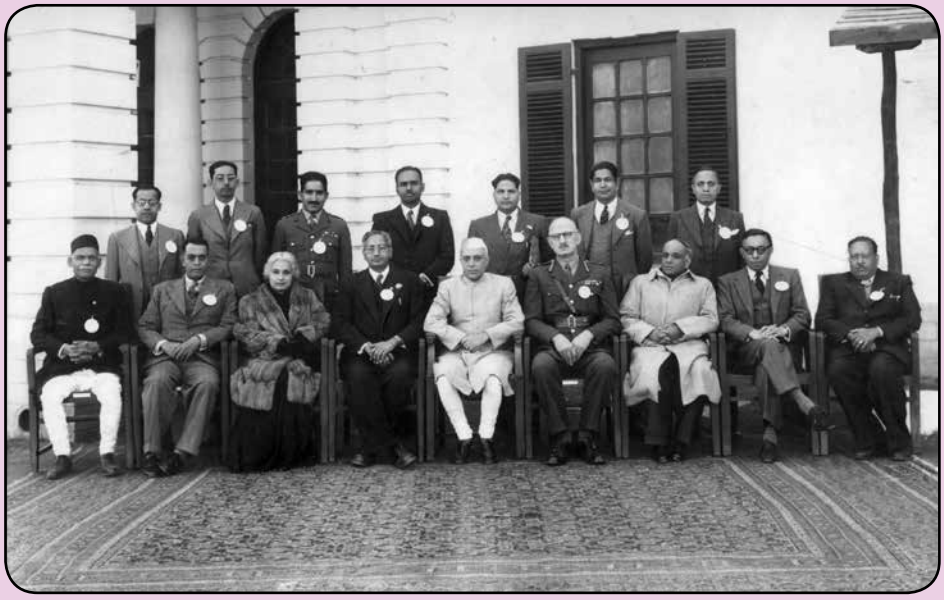
Complete experimental setup

drop of each diode was 0.2-0.4 at forward conduction mode. Also since we have not used any other external sources so the output obtained was solemnly from the crystals itself.

3) We have used the concept of sound converging method in order to focus the maximum sound towards the centre of the membrane.

4) As the crystal and membrane were selected our main objective was to get maximum vibration from the membrane as we know more vibration will give more output which is nothing but charge. For these reasons we started placing crystals at different positions of the membrane. Through several tests we found that the vibration towards the centre is more. As a result we placed each of the crystals in such a way that their weighting elements remained concentrated towards the centre thus sensing the maximum vibrations. Our circuit is nothing but an adder circuit which sums up charge generated by each crystal. For these reasons we placed our crystals focusing towards the centre. Also the sensor used had a small weight on the top of the film which provided better results during vibrations. Thus because of this we have placed the sensors towards the centre in order to sense the maximum possible vibration from the surroundings.

Legacy of IEI



Pandit Jawaharlal Nehru, First Prime Minister of India, during the Annual Meeting of Central India Centre of IEI in 1950

Extraction of Electrical Energy from Wind using Turbo-Ventilator

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OBJECTIVES

Electricity is the set of physical phenomena associated with the presence and flow of electric charge. Electricity plays a vital role in day to day life. Without electricity it is difficult to lead our life comfortably. There are a plenty of ways by which electrical energy can be produced which includes the usage of both renewable and non-renewable energy sources. Among various alternatives it is found that wind is best source for producing high amount of electrical energy. This research introduces the device Turbo-ventilator for the production of electricity means of its free air driven capability. As it rotates with a maximum of 100 rpm, it has to be converted to the required rpm that can be done by including Gear box. After considering the losses it has taken minimum rpm as 60 to be converted to about 1500 rpm capable of running an alternator. The shaft of the turbo-ventilator and the shaft of the alternator were connected using the gear assembly. The turbo-ventilator rotates at 60 rpm the alternator can rotate at about 1500 rpm due to which an excitation is created inside the alternator. This excitation produces electrical energy capable of charging 12 V, 45 A battery. Thus it produces the power of about 400 W approximately at a considerably low cost and it is also proved experimentally.

ACHIEVEMENTS

The wind operated vertical shaft turbo-ventilator electrical power generation system showed improved results in terms of rotates at high torque with the minimum wind velocity. The system analyzed with the various categories from the research articles and the results collected and compared with the theoretical model analysis. The experimental results from the system are to be studied in various parameters and compared with the existing experimental results. It is concluded that the power output is high only when the wind speed more than 3 m/sec. Thus the following suggestions are made for the future research work.

- If it is implemented in the area where the wind speed is approximately 3 m/sec, a required amount of power can be extracted from this designed and fabricated power generation system.
- And this research only with the simple fabrication methods has been used for the experiment setup. Thus by utilizing various new machining process and exact design setup, the losses can surely be reduced and thus improved results will be achieved.

At present, one of the main problems faced in India is the shortage of electricity. The rate of production of electricity is lesser than the rate of usage. The usage of non-renewable sources of energy has also been not so encouraging. Also the Nuclear power plants are hazardous to the environment. To overcome these problems, Turbo-Ventilator is used for power production. As it performs dual functions i.e. circulation of fresh air and production of electricity. The production of electricity is economical as well as pollution free. The implementation of this system on a mass scall can serve domestic, industrial, institutional purposes etc. The power produced by the combination of two or three Turbo-Ventilators can be used for single household appliances in remote areas.

VAWT Assembly

VAWT Propeller Assembly

VAWT Assembly

VAWT alternator with gear assembly

Any efficiency losses with regards to all blades not producing lift is taken account of during the design phase. A vertical axis wind turbine does not need to track wind and takes the wind from any direction, it take advantage of gusts and turbulence. Horizontal axis wind turbines do not like gusts or turbulence, as gusts generally come from a different direction to the prevailing wind. Gusts mean fatigue in horizontal axis wind turbines. The small vertical axis wind turbine developed showed 0.43 peak aerodynamic efficiency in a wind tunnel compared to horizontal axis wind turbines typical 0.5. And this, coupled with aerodynamic scale effects, can produce similar efficiencies for vertical axis wind turbines to horizontal axis wind turbines at large scale.

There are a number of projects underway to commercialize large vertical axis wind turbines for offshore use, and there is good reason to believe that it have advantages. Vertical axis wind turbines offer three big advantages that could reduce the cost of wind energy: a lower turbine centre of gravity; reduced machine complexity; and better scalability to very large sizes. A lower centre of gravity means improved stability afloat and lower gravitational fatigue loads. Additionally, the drive train on a vertical axis wind turbine is at or near the surface, potentially making maintenance easier and less time-consuming. Fewer parts, lower fatigue loads and simpler maintenance all lead to reduced maintenance costs.

PUBLICATIONS

1. Pradhapraj M, Gokul V, Loganathan A R, Mohamed Raseedhukhan M, "Extraction of Electrical Energy from wind using Turbo-Ventilator" International conference on emerging trends and science (ICEETS-2016) on 29th March 2016.

Automated Unmanned Level Crossing Barrier Control and Supervision

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OBJECTIVES

This project deals with automated unmanned level crossing barrier control. In India, the railway crossing system is generally a manually operated level-crossing. In the far remote areas, no barriers or signaling systems are present. This project aims at protecting the traffic vehicles and pedestrians from accidents with the trains passing at regular intervals. As India has the busiest and the densest railway network in the world, therefore the frequency of passing trains is very high. So due to human errors and absence of proper protection, every year thousands of accidents occur, therefore protection holds great importance. In this regard we are implementing a Programmable Logical Controller based automated system without the use of human resource, which will control the opening and closing of the barrier to stop people and vehicles from crossing the road. The project aims at reducing the accidents and fatalities rate by controlling the barrier. The sensors installed on the rails will sense the incoming train and sends the signals to PLC. The PLC in response sends signals to the barriers. The barriers will revert once the train passes. PLCs are used because they are flexible, cost effective, reduces complexity, minimizes errors and easily controllable. The system can be controlled and supervised from nearby railway stations using Supervisory Control and Data Acquisition System (SCADA).

Students working on interfacing of PLC and Arduino

A view of Barrier system including control structure

ACHIEVEMENTS

This project deals with automated unmanned level crossing barrier control. In India, the railway crossing system is generally a manually operated level-crossing. In the far remote areas, no barriers or signaling systems are present. This project aims at protecting the traffic vehicles and pedestrians from accidents with the trains passing at regular intervals. As India has the busiest and the densest railway network in the world, therefore the frequency of passing trains is very high. So due to human errors and absence of proper protection, every year thousands of accidents occur, therefore protection holds great importance. In this regard a Programmable Logical Controller based automated system without the use of human resource, which controls the opening and closing of the barrier to stop people and vehicles from crossing the road is implemented. The project aims at reducing the accidents and fatalities rate by controlling the barrier. The sensors installed on the rails will sense the incoming train and sends the signals to PLC. The PLC in response sends signals to the barriers. The barriers will revert once the train passes. PLCs are used because they are flexible, cost effective, reduces complexity, minimizes errors and easily controllable. The system can be controlled and supervised from nearby railway stations using Supervisory Control and Data Acquisition System (SCADA).

Since in India, the electrification is only 39.92% according to the official data from Indian railways, and this system not being dedicated to only the electrified railways, it is so designed that it proves to be a completely isolated and standalone system that fetches its electrical power from the solar collectors installed at the site of the system. The system being a wireless one, eliminates the use of wired communication between the transmitter and the receiver. This on the other hand eliminates the risk of damage/theft of the underground cables used for communication.

Programmable Logic Controller (abbreviated as PLC) is a user friendly device used for some special task, contains microprocessor that carries out control functions of many types and levels of complexity. Its purpose is to monitor crucial process parameters and adjust process operations accordingly. It can be programmed, controlled and operated by a person unskilled in operating computers. Essentially, a PLC's operator draws the lines and devices of ladder diagram with a keyboard onto a display screen. The resulting drawing is converted in to machine language and make it device compatible. It can operate any system with variable analog inputs and outputs as well as digital inputs and outputs. The Programmable Logic Controller (PLC) can be operated on the inputs side by ON/OFF devices or by variable (analog) input devices. Control engineering has evolved over time. In the past, human was the main method for controlling a system. More recently electricity has been used for control and early electrical control was based on relays. These relays allow power to switched on and off without a mechanical switch.

> Engineering is the science of economy, of conserving the energy, kinetic and potential, provided and stored up by nature for the use of man. It is the business of engineering to utilize this energy to the best advantage, so that there may be the least possible waste.
>
> *William A. Smith, 1908*

Design and Development of Grid –Tied Inverter for Renewable Source Applications

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OBJECTIVES

- To provide uninterrupted supply using renewable sources.
- To achieve hybrid power generation using an MPPT Charge controller and an inverter.
- To synchronize the generated power with the reference single phase supply and thus give back power to the grid.

ACHIEVEMENTS

- Uninterrupted Power Supply using solar energy is realized.
- Achieved hybrid power generation using an MPPT Charge controller and an inverter.
- Synchronized the generated power with the reference single phase supply.

Wind turbine

Inverter with charge controller

"To give real service, you must add something which cannot be bought or measured with money"

Sir M. Visvesvarayya

Detection of Endodontic Therapy using image Processing

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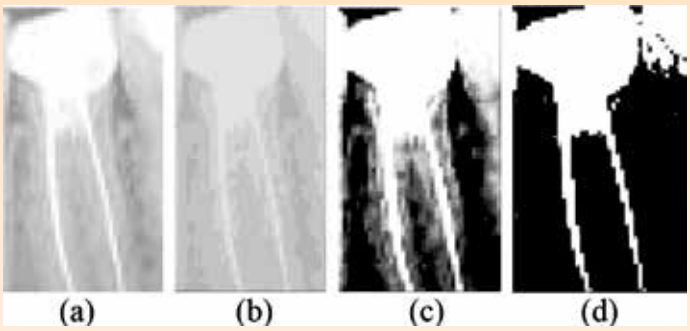
OBJECTIVES

This project "Endodontic Working Length Measurement" is a system which could be used to determine the root length of each tooth. The system was developed by a semi automated image system. Filtering and segmentation are important tool in medical image processing. X-ray images is the best way to determine the exact root length. In this project, images were filtered using Frost filter and segmented using Statistical Thresholding. These images will be used in endodontic root length determination. An semi automatic system is developed where we manually select the area and global thresholding is done. The Binary Tree algorithm which can be used to determine the root length and width of each individual tooth. The length determination results obtained is found to be accurate and efficient.

Input Dental dicom image



(a) Selected Region (b) Filtered Image (c) Histogram Equalized Result (d) Thresholed Image

ACHIEVEMENTS

Developed an Endodontic working length determination System:

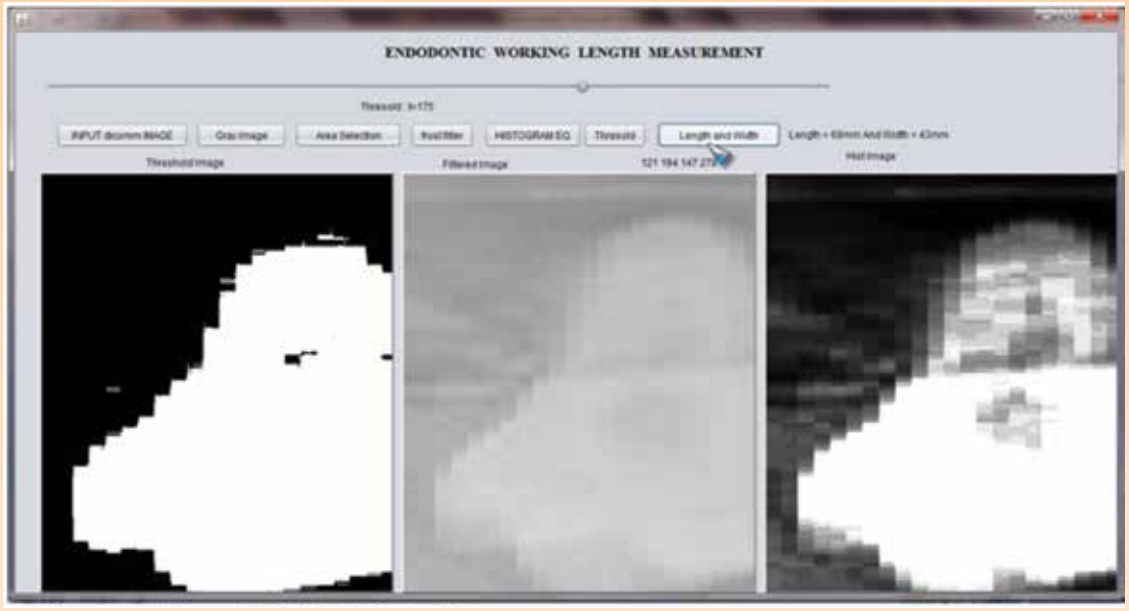
Most of the doctors are using their experience to measure the endodontic working length, by just making a qualitative analysis of the x-ray images. An Endodontic working length determination algorithm is developed. It uses statistical thresholding along with a Binary Tree algorithm for efficient measurement of root length. The Binary Tree algorithm mentioned here proves to be more accurate.

Experimental Results

In primary teeth, it is important to estimate the exact root canal length during endodontic therapy to avoid injury to the succedaneums tooth bud. The root canals are generally thin and the instrumentation of the canal may result in perforation or root fractures. Therefore, to determine the length to which working instruments should be moved forward within the root canal and at what point the preparation and obturation should be placed is

are the major concerns in the endodontic therapy. A technique that is used in determining the root canal length must give precise and reproducible results. The measured lengths in terms of the pixels are then calibrated in terms of millimeters to provide ease in measurement for the dentists. Here, all the images taken are having a resolution of 300 pixels per inch.

- 1 inch=300 pixels, 1 pixel= 1/300 (inch), 1mm=0.039inch



Length and Width Calculation

OUTPUT: Root Length and Width

Length = 60mm And Width = 43mm

PUBLICATIONS

- Presented a paper in National Level Technical Symposium Technodrive'16 organized by Dr Sivanthi Aditanar College of Engineering on 30-03-2016 titled "An Edge Detection Scheme for Endodontic Working Length Measurement Using Image processing Techniques"

Legacy of IEI

Shri V P Singh, Chief Minister of Uttar Pradesh inaugurating 60th Annual General Meeting & Diamond Jubilee Celebration of Uttar Pradesh State Centre of the Institution in 1981

Automatic Blister Pack Quality Monitoring System for Small and Medium scale Pharmaceutical Firms (SMPFs)

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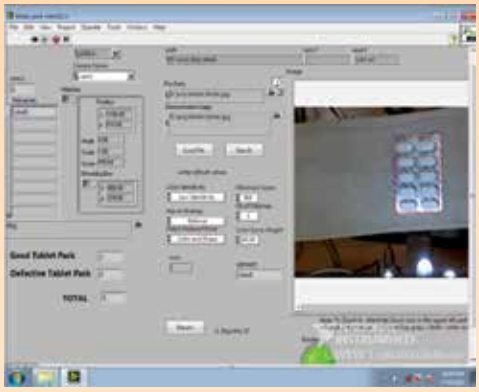
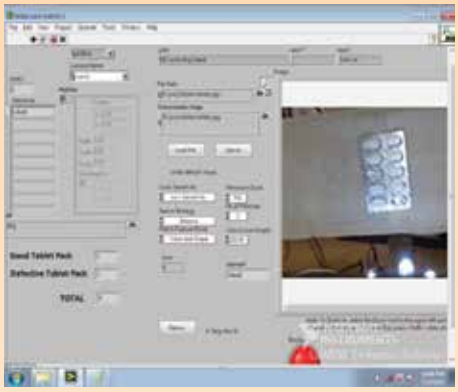


Good tablet pack output



Defective tablet pack output (Missing tablet)

OBJECTIVES

The objective of the project is to provide small scale pharmaceutical enterprises with low cost yet most efficient system using Embedded vision technology which detect the tablet packs for the presence of below listed defects:

- Missing tablets.
- Damaged tablets.
- Wrongly sized tablets.
- Color difference between tablets.

ACHIEVEMENTS

In this project work a cost efficient yet effective system was proposed to monitor the quality of tablet packs in pharmaceutical industry. This prototype is a solution for small scale pharmaceutical companies where the inspection of tablet packs are done manually. The proposed system was analyzed with different type of samples such as defective and non-defective tablet packs and also different kinds of tablet packs such as clear PVC pack, colored PVC pack and capsule pack. The defective blisters were easily identified and segregated.

PUBLICATIONS

- Conference: Ratish Rao, B.Surekha, "Automatic Tablet Pack Quality Monitoring System for Small Scale Pharmaceutical firms", National conference on Information, Communication , VLSI and Embedded System, 16-17 March, 2016, Adhiyamaan College of Engineering, Hosur, Tamilnadu. (Received Best paper award)
- Journal: Ratish Rao.N, Dr.Surekha B. "Automatic Tablet Pack Quality Monitoring System for Small Scale Pharmaceutical Firms". International Journal of Engineering Research & Science (IJOER), Volume-2, March- 2016, pp 73-79.

Design and Development of an Indigenous Parabolic Shaped Solar Cooker

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OBJECTIVES

The main objective of the proposed project is to design and develop an indigenous model of Parabolic Solar cooker with an aperture diameter of 1.5 meter for domestic cooking.

Intermediate objectives:

- Study of the existing parabolic cookers in the market and their technical snags.
- Precise Design of the dish to attain peak temperatures at the focal point of parabolic dish.
- Analysis on feasibility and performance of the product.
- Comparative studies with other sources of cooking.

The use of solar energy to cook food presents a viable alternative to the use of fuel wood, kerosene, and other traditionally used fuels in developing countries for cooking food. Solar cooking can be used as an effective mitigation tool.

Final assembly of solar setup

Conducting test on setup during summer

ACHIEVEMENTS

By experimental work, we achieved effective heating of fluids and food items over copper vessel. The experiments were conducted during days of clear sunshine. The performances of the reflectors were evaluated, by comparing the temperatures rises of the water in the two receivers. The result shows that the average maximum temperatures attained were 66°C and 47°C by mirror and aluminium foil reflectors, respectively in winter conditions and 96°C and 72°C by mirror and aluminium foil reflectors in summer conditions.

Bench Scale Model of Artificial Recharge Structure

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OBJECTIVES

In India the groundwater problem is more prominent in areas with a high agriculture economy, though it is high in urban areas as well. Artificial methods to recharge the groundwater can be used to supplement our water resources. Worldwide artificial recharging of groundwater by using the suitable recharge structure is carried out to augment the amount of groundwater available and increase the natural replenishment or percolation of surface waters into groundwater aquifers. But the construction of different recharge structures in arid and semi-arid has not proved worthwhile, as these structures are not properly constructed and their infiltration and purification capacity is extremely low under natural conditions.

Specific objectives is (i) to fabricate a bench scale model of artificial recharge structure which can overcome the shortcomings of existing structure and (ii) to evaluate the Efficiency of these bench scale reactor.

ACHIEVEMENTS

1. From the sieve analysis it is clear that the particle distribution curve is of coarse graded soil so the voids will be more and corresponding to this the discharge capacity of the Bench scale model was 68.168ml/min.
2. The recharge structures show high infiltration and purification capacities and their overall performances are much better than the prevailing recharge structures as TSS, BOD, COD, NH3, NO3, SO4, Dissolved solids, Total Hardness and Turbidity: 48%,66.66%,48.64,100%,77.92%,22.22%,16.66%,66.66%, 37.60%.
3. The constructions of these recharge structures are easily and economically feasible.
4. The designed recharge structures can be easily installed and constructed within a watershed area.
5. The bench scale reactor is highly capable of removing TSS ranging from 5 to 20 mg/L
6. The bench scale reactor is highly efficient in removing Ni, Cu, Al and Zn by 50, 55, 61 and 78% respectively. It reduces Fe and Pb concentration by 18 and 14 %. Co, Mn and Cr concentration remain unaffected after passing through bench scale model.

Bench scale model unfilled

Bench scale model of artificial recharge structure

Experimental Studies on Utilisation Sugarcane Bagasse Ash in Production of Concrete

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OBJECTIVES

Our objective is to use SCBA concrete as precast concrete that can fulfil the requirements of precast industry where strength and durability of structure are the important aspects to be considered while designing and constructing structures. We propose to use SCBA as partial replacement to cement in concrete by 10% and 20%. We propose to design concrete mix of grade M30 and M50 which are required for precast concrete. We propose to conduct compressive strength and split tensile strength tests on concrete. To test for durability of concrete in sea water, fresh water and sea water are used for curing for 7, 14, 28, 45, 60 and 90 days. Based on experimental results mathematical equation will be derived that can give relation between tensile strength and compressive strength of SCBA concrete. We would like to conduct Scanning electron microscopy analysis (SEM) on concrete to interpret SCBA-cement dense forming phase

Sugarcane bagasse ash

Casting concrete specimens

ACHIEVEMENTS

Chemical composition of SCBA indicates that it can be used as supplementary cementitious material in concrete. Fineness of SCBA is in acceptable range to use as cementitious material. Chemical composition of SCBA shows the high content of silica which is the reason for its pozzolanic reaction. Silica present in ash comes from epidermis of plant cells through absorption of monosilica acid from soil. Water absorption of SCBA effects the total water content in the concrete. We need to increase super plasticizer content to 1% of cement content to get required workability. Present study recommends class-I SCBA can replace cement by 10-15% its weight and class-II SCBA can replace cement by 10% of its weight. Beyond 15% of replacement we can observe decrease in strength because excessive silica content in SCBA remains unreactive and effects durability of concrete by forming cracks. Compressive strength results of SCBA concrete curing in sea water indicate that SCBA concrete can also utilized in off shore and on shore construction. SEM analysis on 10% replaced SCBA concrete shows the dense phase between cement and SCBA and it shows less $Ca(OH)_2$. Tensile strength of SCBA concrete is 7.5% of its compressive strength.

By these studies we recommend that for the construction of precast metro rail segments 10-15% replaced class-I SCBA concrete can be used and 20% replaced class-I SCBA concrete can be used in manufacturing of solid and AAC blocks which are used in block work of metro stations. 10% replaced class-II SCBA concrete can be used in manufacturing of blocks.

By utilizing SCBA as partial replacement to cement can be feasible and economically advantageous by obtaining carbon credits by bringing down the production of cement. Total production of SCBA is sufficient to replace cement by 10% as emissions arising from these products are lower than those occurred in conventional products.

Initiatives to reduce environmental impacts in the industry and reuse of waste generated are strategically of great relevance in current international scenario. In this sense ,the use of SCBA as an additive in the manufacture of concrete goes towards global yearning for environmentally correct product technology. Feasibility of implementing this type projects should consider financial and economic analysis.

Legacy of IEI

Smt Pratibha Devisingh Patil, President of India, lighting the lamp to mark the General Assembly 2007 of the World Federation of Engineering Organizations (WFEO), hosted by The Institution of Engineers (India) at New Delhi

Indigenous Clamp for Medical and Research Lab Applications

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OBJECTIVES

The main aim of the project is to develop an innovate clamp called "Maxrange Clamp" which can withhold the irregular objects effectively. Usage of clamp is more common in many industrial and non-industrial applications. Most widely used clamp in present scenario is C-clamp, where the clamping force is achieved by tightening the jaw with the help of screw. Due to the design constraints of the C-clamp, it cannot meet the multi-use requirement of user and it can't effectively withhold the irregular shaped objects generally used in chemical labs and medical industries. This led us to design a new and versatile clamp for meeting the requirements of the aesthetics and functionality as well. Design intent is to fulfill requirement of low weight with maximum clamping force.

The important features are –

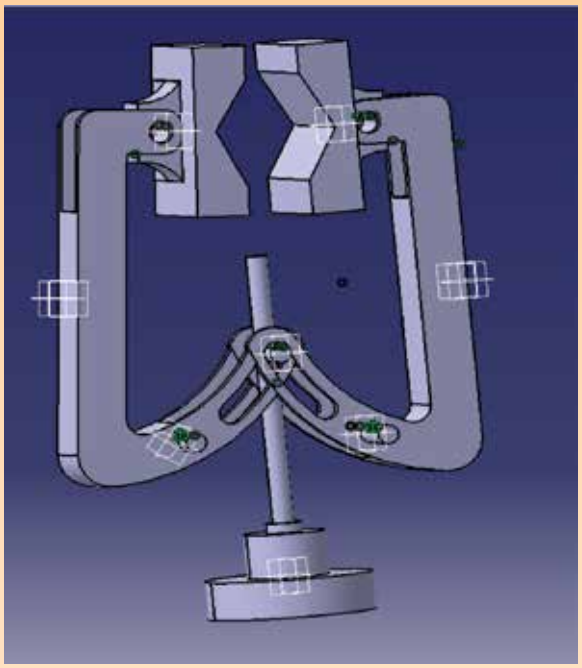
- It can clamp objects of irregular shapes effectively
- It is of less weight and low cost
- It will be great help for various industries for carrying out their regular functionalities.

Indigenous Clamp

Students' with clamp

ACHIEVEMENTS

A clamp is a device that helps to hold object tightly together to prevent movement or separation through the application of inward pressure. In the market mainly now a day's C-clamp is available having wide application, so we mainly consider our clamp with C-clamp. The main advantage of using C-Clamp is its ease of design and construction. It can be used in industrial and as well as non-industrial purpose to hold regular shaped object. The main disadvantage of using C-Clamp is that it cannot hold irregular shaped object.



To overcome this kind of problem we have developed such kind of a clamp which can hold regular as well as irregular shaped object, cost of the clamp is low, efficiency of the clamp should be higher than other. This can be called as 'Maxrange clamp'. With the comparison of C-clamp, indigenous clamp is much more efficient and sustainable. The main principle of this clamp is that it is considered as a cantilever beam with point load at the end. When load is acted at the end of the beam, normal stress and bending stress will generate. In both clamp i.e. C-clamp and indigenous clamp, normal and bending stress will generate but for application of same load, amount of generated stress in C-clamp is more than indigenous clamp. For an experimental calculation applying load of 400N in C-clamp generates total stress (normal + bending) of 41.25 N/mm². But for same load and same area, indigenous clamp generates total (normal + bending) 26.75 N/mm² amount of stress.

This can be of help for design houses, chemistry labs, medical applications and electronic shops for carrying out their regular functionalities.

Legacy of IEI

Shri Atal Bihari Vajpayee, Hon'ble Prime Minister of India, greeted by Shri G P Lal, President of the Institution on the occasion of World Congress on Sustainable Development during January 20-23, 2000

Fly Ash Plastic Waste Composite in Bituminous Concrete Mixtures for Development of Highway Roads

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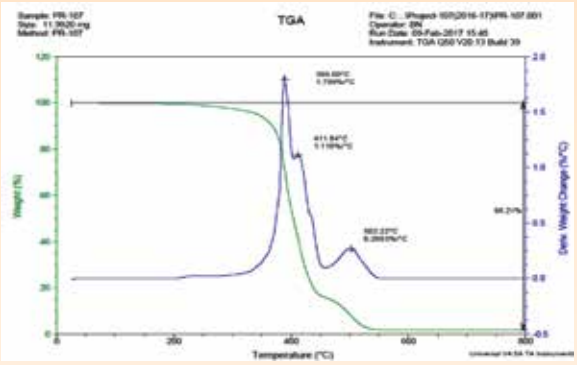
OBJECTIVES

The main objectives of bituminous mix design are:

- To find optimum bitumen content to ensure a durable pavement.
- To find optimum plastic content that can be added to the mix.
- To find sufficient strength to resist shear deformation under traffic at higher temperature.
- To find proper amount of air voids in the compacted bitumen to allow additional compaction done by traffic.
- To ensure sufficient flexibility to avoid cracking due to repeated traffic load.
- To find the stability and flow value using Marshall Test Method.
- To find the optimum ratio of aggregates, bitumen, plastic and fly ash to prepare the best road model.



TG A curve of plastic mix of different grades

Preparation of mix and mould using flyash, plastic and bitumen with aggregates

ACHIEVEMENTS

The experimental data was collected after successful completion of the tests. The test results were then compared with the standards of Indian Road Congress (IRC) and guidelines of National Highway Authority of India (NHAI).

On comparing the results with the standards it was concluded that:

- The aggregates had the properties as specified according to the Indian Standards and they can be used in road construction.
- The bitumen collected was of VG-30 grade and hence it can be used for highway road construction.
- The plastics on getting coated over the aggregates reduced the water absorption and hence should be used in optimum ratio to reduce water absorption and increase durability of roads.

- The fly ash had the properties as specified according to the Indian Standards and it can be used in road construction.

As the material characteristics fulfill the standard requirements hence, these materials can be used for road model preparations.

From the study of characteristics of plastic coated aggregates, we have found that with addition of plastic to the aggregates, various parameters like crushing strength and impact value decreased by almost 50%. Crushing strength value at 0 % plastic content was found to be 22.67%, which decreased to 13.44% on addition of 2% plastic. This value further decreased with increase in plastic content. Hence, it shows better resistance to withstand wheel loads. Similarly, the Impact value at 0% plastic was found to be 24.92%, which decreased to 13.27% on addition of just 2% plastic. The value went on decreasing with addition of more and more plastic. Hence the plastic coated aggregates showed better resistance against impact loads. However, the abrasion value doesn't showed much change but, still it decreased from 25% at 0% plastic to 16% at 8% plastic. From the study of the behaviour of polythene modified bituminous course (BC) it was found that the modified mix possesses improved Marshall Characteristics as mentioned below.

It was observed that Marshall's stability value increases with polyethylene content up to 4% and thereafter decreases. It was observed that Marshall's flow value decreased upon addition of polythene i.e the resistance to deformations under heavy wheel loads increases. Also the values of the parameters like VMA, VA, VFB were within the required specifications.

Considering these factors it can assure that a more stable and durable mix for the pavements by polymer modifications. This small investigation not only utilizes beneficially, the waste non-degradable plastics but also provides us an improved pavement with better strength and longer life period. Polymer modified pavements would be a boon for India's hot and extremely humid climate, where temperatures frequently rises past 50°C and torrential rains create havoc, leaving most of the roads with heavy distresses.

This adversely affects the life of the pavements. The polymer modified bitumen shows improved properties for pavement constructions. This also can reduce the amount of plastics waste which otherwise are considered to be a threat to the hygiene of the environment. In this modification process plastics-waste is coated over aggregate. This increases the surface area of contact at the interface and ensures better bonding between aggregate and bitumen. The polymer coating also reduces the void spaces present in the mix. This prevents the moisture absorption and oxidation of bitumen by entrapped air. The road can withstand heavy traffic and show better service life. This study will have a positive impact on the environment as it will reduce the volume of plastic waste to be disposed off by incineration. To sum up, following are the advantages of using waste plastics in bituminous pavement:

- Stronger road with increased Marshall Stability Value.
- Better resistance towards rain water and water stagnation.
- No stripping and no potholes.
- Increase binding and better bonding of the mix.
- Reduction in pores in aggregate and hence less rutting and ravening.
- The load withstanding property increases. It helps to satisfy today's need of increased road transport.
- For (1km*3.75m) road, 1 ton of plastic (10 lakhs carry bags) is used and 1 ton of bitumen is saved.
- The cost of road construction is also decreased.
- The maintenance cost of road is almost zero.
- Disposal of waste plastic will no longer be a problem.
- The use of waste plastics on the road has helped to provide better place for burying the plastic waste without causing disposal problem.

Development of 400VA Linear Alternator for Sterling Engine based Solar Thermal Applications

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OBJECTIVES

The objective of this proposal

- Design and optimization of the equipment,
- Engineering and processing information for New indigenous Product (215V/400VA/50Hz-Linear Alternator),

Rotor of the linear alternator

Details
The rotor is made up of with 3 permanent magnets and supported with pole shoes. Adjacent magnets have opposite polarity and a movement of the rotor creates an altering magnetic field in the stator coils. The flux is led from the magnets through bars of magnetic steel, called pole shoes. The pole shoe enables control of the magnetic flux distributions in the periphery of the air gap and it also protects the magnets from transient magnetic fields generated by short circuit in the outer circuit.

Stator of the Linear Alternator

Details
The stator is made of laminated electrical steel. In this project 5 coils are used with 80 turns/coil and the total resistance is 30Ω. This winding Configuration aims at minimizing the fluctuation in the output power caused by cogging.

- Establishment of test facility.
- Establishing a platform for Technological Capability.
- Review of R & D in the proposed area (National & International Status, Importance, Patents etc.).

ACHIEVEMENTS

a. Engineering design and desktop optimization of the alternator,
b. Detailed design and fabrication of components,
c. Assembly of the prototype and design refinements,
d. Testing of prototype and verification of performance parameter

Final setup of alternator

Working

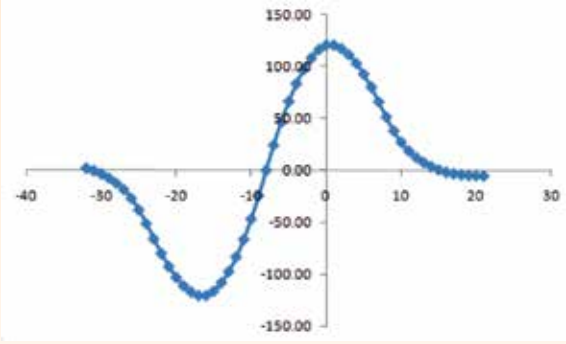
The translator acts as the rotor that moves linearly while the stator is fixed. Permanent magnets are attached to the rotor and the stator carries the windings.

With the movement of the jigsaw the rotor is moving up and down linearly. As the rotor is having the magnets on it, it produces strong magnetic field, which cuts the flux in the winding , inducing the e.m.f .

This generator design is best suited for the generation of the electricity from the wave energy.

Results:

Traslatory(mm)	Voltage(v)
5	92.59
4	103.09
3	111.30
2	117.24
1	120.65
0	120.70
-1	116.26
-2	108.26
-3	97.29
-4	83.46
-5	66.69



An AC voltage is generated with the system and the results are as shown in table with the sine wave as shown above.

A Novel Technology of Low Voltage DC Ceiling Grid with Improved Efficiency

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OBJECTIVES

Most commercial buildings consume up to 50% of the electricity generated and distributed by public utilities in the form of AC (Alternating Current). Nowadays, the power demands in these buildings are mostly DC (Direct Current), due to the adoption of DC powered data centres and solid state lighting facilities. The proposed idea deals with the implementation of DC ceiling grid system that interconnects AC and DC and distributes safe, low-voltage DC power to the loads. The main advantage of the proposed DC Grid System is increased efficiency due to reduction in double conversion losses and uninterrupted DC supply on failure of one module. Each module includes a diode rectifier at the front end, followed by a boost converter. The DC output voltage is regulated using an outer proportional-integral controller and the input current wave shape in each phase is improved by three individual hysteresis controllers. The proposed system is a safe and reliable DC power distribution system feeding DC loads like lighting fixtures, PMBLDC fan, laptop and mobile chargers. This DC ceiling grid system can be further developed into an active Power distribution system that tolerate disturbances, are safe and have positive impacts on the power market development.

Polycrystalline Solar Panel (12 V DC), Battery (12 V, 65 Ah), Charge Controller

PMBLDC Fan (25 W, 12 V), LED Lights (12 V), Mobile Charger (Buck Converter 12 / 5 V)

ACHIEVEMENTS

This project titled "A Novel Technology of Low Voltage DC Ceiling Grid with Improved Efficiency" is successfully implemented as a prototype model in the HOD's cabin. The primary source is solar PV system and the secondary source is battery. When there is insufficient power from the above sources AC Grid will be used thus providing uninterrupted power supply to the DC loads with increased reliability and efficiency. Globally, consequent reduction of electrical energy consumption is significant, but is particularly critical in emerging economic countries like India. Indian Low-Voltage DC Forum is launched by IEEE - Advancing Technology for Humanity, comprising of several industries, institutes and government agencies. The forum will drive the reduction of electricity demand by sensible application of LVDC power distribution and minimising AC-DC conversions. This will also significantly accelerate the utilisation of renewable energy in creating an environmental impact. Hence, this project will definitely have a strategic importance in meeting the rapidly increasing needs for energy, but with more efficient "green attributes".

PUBLICATIONS

Paper titled, "A Novel Technology of Low Voltage DC Ceiling Grid with Improved Efficiency" has been presented in the International Innovation and Technology Summit, "SWITCH 2016", at Vadodara, Gujarat on 06th Oct 2016.

A City Passenger Vehicle Powered by Solar Panels

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The complete project model

The skeleton of the car (complete chassis)

OBJECTIVES

The objective of this project was to develop a solar driven car, effectively utilizing the unlimited supply of energy from sun. The project aims at building a single-seater solar powered vehicle, helpful for intercity travel.

ACHIEVEMENTS

Gasoline independence: A solar based car is essentially gasoline independent and along these lines it is easy on your pocket and the environment. A traditional car adds to the all ready high air pollution levels, whereas, a solar powered car does not produce any harmful emissions.

Solar cars are noiseless: A solar powered car is exceptionally quiet and runs noiselessly, thereby, cutting the noise pollution that comes complimentary with fuel-driven cars.

Longer life span: A solar car can easily last decades without any expensive regular upkeep.

Low maintenance: The solar vehicles are specially designed to be low maintenance and can be easily maintained to last years with general cleaning of the solar panels.

Eco-friendly: One of the most significant benefits of a solar powered vehicle is that it is highly nature-friendly. Solar powered automobiles produce a negligible amount of greenhouse gasses that are responsible for the depletion of the protective ozone layer.

Renewable and infinite source of energy: The sun is one of the biggest renewable sources of energy and running solar powered vehicles does not require any natural resources that are on the verge of extinction.

Development of Set up for Selection of Alternative Heat Transfer Fluids for Direct Absorption of Solar Energy

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OBJECTIVES

The photo thermal property is very important for the assessment of solar energy absorption as it directly reflects the ability to convert light energy to thermal energy for heat transfer fluids. Hence, the photo thermal properties of alternative heat transfer fluids will be investigated.

Variety of nanomaterials has been used for different thermal applications for efficiency enhancement and improved heat transfer.

The main objectives of the proposed project are as follows:

1. Development of a photo thermal property measuring system
2. Experimental study of photo thermal property of alternative heat transfer fluids like Al_2O_3-water nanofluids
3. Side by side comparison of photo thermal capacity of alternative heat transfers fluids in the same outdoor conditions.
4. To find alternative solar absorption fluid through measurement of photo thermal properties.

Actual Set up during experimentation

Prepared Nano-fluid through Ultrasonication

ACHIEVEMENTS

1. Mixing of small amount of nanoparticles to pure water change the photo thermal capacity of water.
2. The photo thermal properties experiments show that nanofluids have good solar absorption ability and can effectively enhance the solar absorption efficiency.
3. Significant enhancement in solar radiation absorption make nano-fluids as a suitable heat transfer fluid for solar thermal applications and can also be used in solar collectors for effectively capturing and transporting thermal energy to ever-growing industrial and domestic needs.

PUBLICATION

1. Gupta H.K., Shubham, Vaibhav (2017) ; Study of alternative heat transfer fluid for direct absorption of solar energy, National conference on Recent Innovations in Mechanical Engineering (NCRIME-2017), VGU & VIT CAMPUS, Jaipur, March 23-24, 2017.

Development of MEMS based Pocket Factory for Sustainable Manufacturing System

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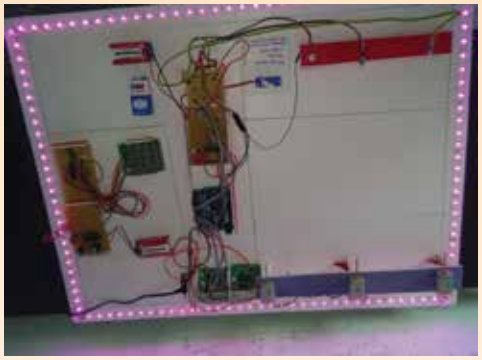
OBJECTIVES

- Fabricate Micro lathe, Micro drilling machine, Micro grinding machine and Micro robot for micro manufacturing system
- Develop MEMS based pocket factory for sustainable manufacturing system
- Conduct performance test and error analysis test to pocket factory micro machines
- Find total performance analysis for pocket factory manufacturing system
- Enormous saving of Energy, space, time, material and all resources.

Mems devices for used Pocket Factory



Mems based Pocket factory for sustainable manufacturing system

ACHIEVEMENTS

MEMS based pocket factory has been developed and attain sustainable manufacturing system is thereby attained.

MEMS based micro machines have been used for conducting error analysis test and alignment test.

Total performance test has been conducted for pocket factory system.

Micro machine runs with lower electrical power, occupy less space and save all other resources.

MEMS based pocket factory is greater savings of energy, space, material and time.

PUBLICATIONS

1. Patent filed and Journal Published in the title of Development of Micro leaf Jig for Micro components at PATENT OFFICE,Chennai 0n 30.12.2016
2. Paper presented in International Techno management fest at SASTRA UNIVERSITY, Thanjavur on 24.02.2017.
3. Paper presented in the topic of MEMS based pocket factory in National Level Technical Symposium on TRICHY ENGG COLLEGE,Trichy on 16.03.2017.
4. Paper Presented in the topic of portable mini lathe in All India Seminar on Innovations,Technology and Knowledge Economy on 17.03.2017.

Experimental Investigation and Optimization of Milling Parameters for Machining Aluminium Silicon Carbide Composite using Design of Experiments Approach

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Weighing Machine

Infra Red Temperature Gun

Oven

Furnace

OBJECTIVES

In this project work, the experimental work is carried out to investigate the input process parameters of milling process on Aluminium Silicon Carbide Composite materials using the Bhagwan Udyog Vertical Milling Machine in Saranathan College of Engineering, Trichy. The input parameter of the milling process is to be analyzed for obtaining better quality and strength of the specimen and to improve the productivity. The output responses namely, Metal Removal Rate, Surface Roughness, Temperature and Machining Time are considered as objective responses. The optimum level of milling process parameters is crucial for the engineering industry to satisfy the customer needs and specifications. In this work, Taguchi Design of Experiments (DOE) technique and Grey Relational Analysis (GRA) have been used for obtaining the optimum level of input process parameters.

The objectives of the work are listed below:

- To prepare the specimen and select the input process parameters based on the previous research work, past experience and machine specifications
- To conduct an experimental procedure based on the Design of Experiments concept for solving single response problem
- To conduct an experimental procedure based on Grey Relational Analysis (GRA) for multi response problem
- To investigate the effect of process parameters on the output responses like Metal Removal Rate, Surface Roughness, Temperature and machining Time
- To predict the optimum level of input parameters for milling of Aluminium Silicon Carbide Composite materials for solving single response problem using Taguchi optimization technique
- To predict the optimum level of input parameters for milling of Aluminium Silicon Carbide Composite materials for solving combined objective problem using Grey Relational Analysis
- To analyze the results from the experimental investigation using Taguchi Design of Experiments (DOE) and Grey Relational Analysis (GRA)
- To validate the experimental outputs.

ACHIEVEMENTS

Today, the objective of the manufacturing industries is to achieve the economical machining condition. Since, milling has metal removal rate and good surface finish, it is very essential to predict the optimized parameters. The reduction of experimental time will abruptly increase the cost and reduce the quality. This project work is carried out to overcome these difficulties. The need for milling of aluminium silicon carbide composite is increasing day by day as it finds its applications in many industries. Hence, finding the influence of process parameters is crucial in the milling process. In this work, optimization and analysis were carried out successfully in the milling process on Aluminium Silicon Carbide Composite.

The following conclusions were derived from the investigations,

- High metal removal rate is obtained in milling process.
- The quality of the milling process mainly depends on selection of the input parameters.
- Taguchi Design of Experiments techniques was successfully employed in the optimization of milling parameters of aluminium silicon carbide composite carried in Bhagawan Udhyog vertical milling machine.
- For maximization of metal removal rate on aluminium silicon carbide composite, depth of cut played important role in metal removal rate. Hence, the optimized parameters for metal removal rate are spindle speed 727 rpm, feed rate 0.1111 mm and depth of cut 1.5 mm.
- For minimization of metal surface roughness on aluminium silicon carbide composite, feed rate influenced the surface roughness. Hence, the optimized parameters for metal surface roughness are spindle speed 727 rpm, feed rate 0.0848 mm, depth of cut 1 mm.
- For minimization of temperature, spindle speed alone influenced the temperature of milling of aluminium silicon carbide composite. Hence, the optimized parameters for temperature are spindle speed 520 rpm, feed rate 0.1111 mm, depth of cut 1 mm.

- For minimization of machining time, feed rate influenced the machining time of milling of aluminium silicon carbide composite. Hence, the optimized parameters for machining time are spindle speed 357 rpm, feed rate 0.1111 mm, depth of cut 1 mm.
- For combined objective of maximization of metal removal rate, minimization of surface roughness, minimization of temperature and minimization of machining time on milling of a aluminium silicon carbide, feed rate played a significant role in the process. Hence, the optimized values for milling of aluminium silicon carbide composite are spindle speed 357 rpm, feed rate 0.1111 mm, depth of cut 1.5 mm.

Taguchi Design of Experiments is employed to set the optimal parameters as well as provide better results for this experimental work. Based on the experimental investigation, it is found that metal removal rate on the 'Larger is better' condition gives better results, surface roughness on the 'Smaller is better' condition gives the better results, temperature on the 'Smaller is better' condition gives the better results, machining time on the 'Smaller is better' condition gives the better results. Grey relational analysis being an uncomplicated process, can be used for any manufacturing industry. This experimental approach is valuable for the researchers to improve the performance characteristics and to predict the optimized parameters.

- Crucible furnace is fabricated.
- Aluminium silicon carbide composite material is casted.
- Temperature is measured for tool and work piece and also analyzed at different levels.
- Optimal machining parameters are identified for face milling operations.

PUBLICATIONS

- Best Project Award - 3rd IEI Tamilnadu State Centre Student's & Technician's Convention and All India Seminar on "Innovation, Technology and Knowledge Economy", K.L.N. College of Engineering, Madurai on 17th March 2017.
- Third Prize - Paper Presentation in National Level Technical Symposium organized by Trichy Engineering College, Konalai, Trichy on 20th March 2017.

With engineering, I view this year's failure as next year's opportunity to try it again. Failures are not something to be avoided. You want to have them happen as quickly as you can so you can make progress rapidly.

Gordon Earle Moore

Proficient System for Effective Production in Agriculture Era using Sensors and Wireless Technology

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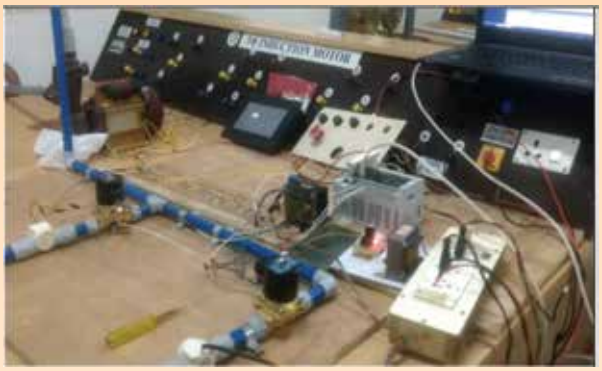

Project Module with during testing

Implementation of the project by the student in the college lawn

OBJECTIVES

- Farming assumes an imperative part in human life and it is considered as the foundation of a country. Agriculturist relies on conventional standard method for cultivating. The real issue that needs to go over is the equivalent conveyance of water everywhere through the field in spite of the differing atmosphere conditions. Therefore, the proposed framework helps the farmers to fortify his advantage towards farming.
- The current traditional system for watering system requires human exertion and the capable framework has been indented to ration water and additionally to spare human endeavours. At the point when the dampness level lowers than the obliged unit it orders the framework to supply the water to the field. When the dampness achieves its obliged level, it naturally summons the framework to close down the water supply.
- This framework includes sensors like flow, moisture, dampness level, temperature level which can be controlled using Programmable Logic Controller.

ACHIEVEMENTS

- Won first prize at Project Presentation held on Sri Ramakrishna Engineering College, Coimbatore.
- Won Best Contribution to the society award during project contest in TECH DAY'17 held at Akshaya College of Engineering and Technology held on 16-03-2017.

Design and Fabrication of Smart Steam Food Maker

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OBJECTIVES

Steamed food occupies a special place in South Indian food style. Especially idly and idiyappam are the most favourite food in South India, even though many products related to food industry are already existing in the market. The study shows that the prevailing home appliances are not featured to prepare the food in an easier way. So we have designed a machine in order to prepare idly and idiyappam in a smarter way. The only work to be done by the person is to fill the flour (idly or idiyappam flour) into the machine and activate it. Then the remaining process such as squeezing the wet flour on to the plate, steaming the wet flour and extruding into a plate as idiyappam or idly outside the machine is done by the system itself. This machine turns the cooking process easier as if switching on the TV, AC, etc.

The unique feature is that it can be operated from distant places through mobile phones. Therefore cooking can be made possible in the absence of persons at home. This makes a great revolution in the art of cooking. Our main objective is to prepare hygienic food in the automated machine in an efficient manner with less consumption of energy.

Front view of smart steam food maker

Currently, many types of string hopper (idiyappam) machines are available in market. One is a rotary type and the other one is the lever type string hopper machine. Rotary type machine which is available in the local market has a main drawback of removing the cylinder for each batch of string hoppers. For this task handle should be rotated until the rack comes to its uppermost position which makes the operator fatigue and consumes more time.

Another one is the lever type string hopper machine which is operated by a lever mechanism connected to a piston. Disadvantage of this machine is that for each 15 hoppers, the cylinder should be refilled by keeping these issues in mind. Our project is design is simple and easily operated; this setup can be used even in medium scale industry. The designed new machine has an ability to stop the string hopper mold rotator at the required position, ease of feeding, and better accessibility for cleaning. This machine is designed in a manner that it requires no human supervision. It constitutes a slider component where the extruded flour has to be filled, which moves to and fro by clockwise and anticlockwise rotation of lead screw. The compression unit with piston cylinder arrangement is moved by prime mover under specific gear reduction unit. The proposed machine is also affordable, particularly for the small and medium scale string hopper manufacturers.

ACHIEVEMENTS

Project has been recognized as best academic project for the year 2016-17.

An Internet of Things Approach for Smart Energy in Class-Rooms using Raspberry Pi

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OBJECTIVES

Smart energy in buildings has drawn significant research attention in the research area of Internet of Things (IoT). As important parts of the smart energy, the saving of consumption of energy in buildings such as homes, class rooms etc. is vital for the environment and global sustainability. The objective of the proposed project is to use electric energy efficiently to provide economic benefits as well as social benefits. This project is mainly concerned with the automatic control class room appliances such as light, fan or air conditioner (AC) for saving of consumption of energy using Internet. In this project, through network technologies, the consumption of energy is continuously monitored in different granularities including the labs, rooms (class and staff) etc. and if any room or lab is found empty (not present any human body), then the power of that room or lab will be cut automatically. In this way this project can improve electric energy efficiency in buildings. This project can develop a real IoT system to control the energy automation. In this project, our aim is to create an energy-efficient IoT framework that can be easily used to all kinds of class rooms and achieve energy savings.

Device model

Image captured by Pi cam and switched ON the devices

ACHIEVEMENTS

In the present work, we developed a new energy efficient portable device and this device can perform very efficiently in all environments. It automatically switches on the lights, fans and others electrical gadgets when someone enters into the classroom. Similarly, when nobody is in the classroom it automatically switches off the electrical gadgets of the classroom. So, the power consumption is reduced. Initially, to setup these devices, it takes some extra cost but for a long term it will be effective with respect to power consumption. It is a portable device and requires only 3V power supply. So, it is easy to install this device into the classroom and can be easily placed in the proper position of the classroom. The pi cam can capture the videos of the classroom and transfers to the server. We can use this technique for student attendance and monitoring also in future.

PUBLICATION

A. Nag and A. Pal An Effective Energy Management System based on Internet of Things (IoT) Framework. Conferenceon Management, Technology, Innovation and Social Change, Amity School of Management and Allied Courses, Amity University Kolkata, 21stFebruary, 2017.

Aerodynamic Investigation of Airfoil with Tubercles

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OBJECTIVES

On the observation of biomimetics of humpback whale prevail its maneuverability and aerodynamic performance could be exploring its flippers. The humpback whale flippers have round and blunted leading edge and tapered trailing edge. The flipper`s leading edge have the supreme authority to maintain the flow control characteristic. We approached the NACA0015 and NACA4415 airfoils keeping in mind the tubercles. The amplitude (A) and wavelength (λ) retain high-priority in the design perspective of tubercle proceedings by using CATIA package. The flow around the BUMP0015 and BUMP4415 was computed on suction side and pressure side at different angles of attack with ANSYS FLUENT package. The aerodynamic coefficients (CL, CD), coefficient of pressure (CP) have explored, modified airfoil compared with baseline airfoil. The stall delay phenomenon was cleared over the analytical results insists on peak, trough and medial region. Numerous graphs have accounted so as to determine the performance enhancements by the flow control .The tubercles leads the post stall characteristics.

ACHIEVEMENTS

To peruse the impact of tubercles initially viscous fluid flow over a baseline airfoils were simulated. The modified airfoils were simulated with same Reynolds number. The analytical work was carried out at the angle of attack range from 0^{o} to 21^{o}. The effect of tubercles was identified based on coefficient of lift, coefficient of drag, coefficient of pressure, velocity vector and streamline pattern.

The implementation of tubercles at the leading edge of airfoil leads to the formation of counter rotating pairs of streamwise vortices between the tubercles peaks (i.e. trough region). The row of tubercles redirects the flow of air into the scalloped valley between each tubercle, causing swirling vortices that roll up and over the airfoil which actually enhances lift properties. The swirling vortices exchange momentum into the flow and this exchange of momentum keeps the flow attached to the suction side of the airfoil and delays stall to higher angles of attack.

As the tappings were positioned on the suction and pressure side for the baseline and modified airfoils, the pressure distribution is elucidated. Extreme care was taken to measure the peak, trough and mid region pressure distribution. The surface pressure measurements were taken varying chordwise positions for the picked airfoil. The chordwise pressure distribution shows the existence of spanwise variation in pressure by means of effective aerodynamic characteristics.

The effects of tubercles on the pre stall and post stall characteristics have been investigated by the surface pressure characteristics. The aerodynamic characteristics had been held by the comparison of baseline and modified airfoils. The important parameters considered when specifying the use of tubercles by amplitude and wavelength. It was found that performance changes, in terms of enhanced lift with minimal drag for modified airfoils, is limited to specific Reynolds number regimes. Analysis of the flow behaviour revealed that a pair of

Project airfoil with project members

Normal and modified airfoils with pressure tappings

Front view of mounting of airfoil

Top view of mounting of airfoil

streamwise counter rotating vortices was generated in the troughs between tubercles and the counter rotating vorticity and circulation where highly dependent on streamwise location and airfoil angle of attack.

The experimental validation shows the pressure distribution on suction and pressure side of the selected airfoils were in agreement with the effective aerodynamic characteristics. There are various opportunities for future work on this proposition considering large number of variables when selecting an optimum tubercle configuration with varying Reynolds number, changing the shape of the tubercles, selecting airfoil with different profile shape.

PUBLICATIONS

1. V. T. Gopinathan, J. Bruce Raphin Rose,V. Gokul, Kamalahasan. K," On the Role of Leading-Edge Tubercles in the Pre-stall and Post-stall Characteristics of Airfoils" presented at National Conference on Wind Tunnel Testing (NCWT-05), Anna University, Madras Institute of Technology Campus and CSIR-SERC, Chennai.16-17 March 2017.
2. V. T. Gopinathan, J. Bruce Raphin Rose,Kannan. P, Kamalahasan. K," Numerical Investigation of the Effect Leading Edge Tubercles at low Reynolds Numbers". Paper selected for 24th National and 2nd International ISHMT-ASTFE Heat and Mass Transfer Conference (IHMTC-2017), 27-30 December 2017, organized by BITS-Pilani (Hyderabad campus)& IIT Hyderabad.

An Integrated Sensor Network to Enhance the Performance of Gully Pot Monitoring

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OBJECTIVES

- To design a Gully Pot Monitoring system capable of providing sufficient information about the level and pH of the sewage
- To identify the presence of toxic gases produced in the Gully Pot to avoid human casualties
- To implement the system that identifies the blockage in the Gully Pot and transmits these information to the nearby base station.

Gully pot monitoring system with integrated sensors

Miniature base station

ACHIEVEMENTS

The prototype model of gully pot monitoring system with miniature base station integrated with sensors has been developed. Based on the results obtained from the developed system, paper has been presented in the second International Conference on Emerging Trends in Science, Engineering and Technology "ICETSET 2017". The conference team has recommended the paper for the possible publication in the journal.

PUBLICATION

Jamuna V, Karthik Sharan. M, Ashwin. S, M, Gopinath. C (2017) 'An Integrated Sensor Network To Enhance The Performance Of Gully Pot Monitoring', International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE). Vol No: 3, Special issue: 13, March 2017,pp No:48-52, ISSN 2452-9762.

Assessment of Subgrade Strength using Dynamic Cone Penetrometer and Developing Correlations between Soil Properties and Penetration Resistance

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Cone Penetration test on reddish sandy soil in field

Cone Penetration test on blackish clay soil in lab

OBJECTIVES

Fabricate a cone penetrometer to standard dimensions and determine the penetration of cone per blow on subgrades at different conditions. To quantify the field dry density and moisture content of different soil layers and correlate the penetration per blow with field moisture content and dry density. Undisturbed soil samples are to be collected and California Bearing ratio test and unconfined compression test are to be conducted under different moisture contents and dry densities. Penetration of cone per blow into the soil samples at different moisture contents and dry density is to be determined and correlate the penetration per blow with California Bearing ratio and unconfined compression test.

ACHIEVEMENTS

Dynamic cone penetration test can be implemented to assess the subgrade strength of soil. Cone penetration test indicates that the penetration per blow increases with the density of soil and vice versa. Penetration in mm per blow is more for a higher moisture content of soil. A loose or soft soil has larger penetration per blow and a low CBR and unconfined compressive strength. In the case of dense and stiff soils, penetration per blow is less and the sample has larger CBR and higher cohesion and angle of internal friction. CBR values determined can be used in the design of flexible pavements and the penetration of cone per blow determined can be used to evaluate the condition of the existing pavement. Unconfined compressive strength, cohesion and angle of internal friction can be used to determine bearing capacity of soil and the penetration of cone per blow indicate the strength of native soil. Improvement of cement treated soil is studied using cone penetration test. Due to cement treatment, UCS and CBR of the sample increase but penetration per blow does not change.

Embedded Based AC Voltage Controller for Induction Heating

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OBJECTIVES

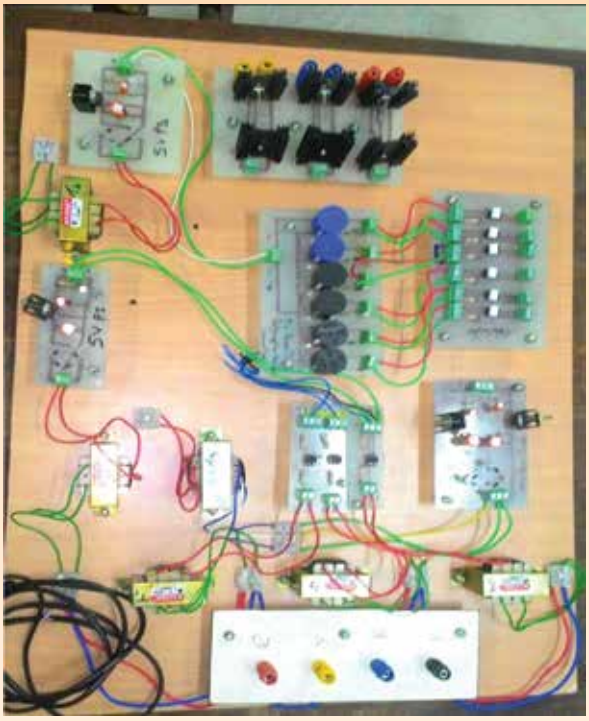
- To design a low cost voltage control circuit for electrical equipments
- To achieve the required output A.C voltage specified by instruments
- To control the firing angle of an A.C voltage controller by using ArduinoAtmega2560
- To save the life of the electrical equipments
- To adjust required voltage precisely for the permissible amount of heating needed
- To save the economical power losses by using this controller.

ACHIEVEMENTS

- Life time design of the electrical equipment was improved and its cost get reduced.
- The improvement of equipment immunity and Injection of power to compensate lost voltage.
- Provide uninterrupted clear supply and power supply quality was improved.
- Reduced the number and duration of faults.

PUBLICATION

Presented a Paper at National Level Conference (PEPS 2K17) on 05/04/2017 conducted by Dr. Sivanthi Aditanar College of Engineering



Hardware Circuit for AC Voltage Controller

IoT for Security Applications

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OBJECTIVES

Connected home security systems offer a myriad of features including door and window sensors, motion detectors, video cameras, and recording mechanisms—all connected via the cloud to a mobile device or the web. The intent of these systems is to provide security and remote monitoring to a home owner.

ACHIEVEMENTS

The IoT based security and home controlling system, developed in this project, is providing security to the home and also providing a facility to the user where one can continuously monitor the physical parameters inside the house (like temperature, smoke and light) and can control them by switching on/off devices (like fan and light). Raspberry Pi microcontroller has used for all controlling operations and different types of sensors along with a camera and LAN connection is interfaced to the pi board. This project also provides the security to the home. When the intruders enters into the house images of the intruder is captured and sent to the mail. Those images can be used to recover the stolen things. So security to the home is provided effectively. Home appliances are automated to reduce the human effort with the help of IoT. This compact and lightweight product has been designed to provide security and to control home appliances in the house by the owner.

Output when Talkback is D2 ON

Mail Sent on Intruder Detection

Experimental Investigation on Free Oscillations of Tension Leg Platform Wind Turbine

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Installed Model

Data Acquisition System

OBJECTIVES

To design the offshore tension leg platform wind turbine which can support 5MW

To develop the mass distribution of offshore tension leg platform wind turbine

To study the natural periods of offshore tension leg platform wind turbine in different degrees of freedom by performing free oscillation experiments on scaled model.

ACHIEVEMENTS

A tension leg platform with 8943t displacement is designed to support 5MW capacity wind turbine at a water depth of 60cm. The structure is verified for hydrostatics in free floating condition with the designed mass distribution. Froude scaling is used to scale down the model. Geometric and dynamic similarities are used. 1:100 scaled model is fabricated with the locally available material. The model is installed at a water depth of 60cm and free oscillation tests is conducted. The time series of the free oscillations in surge, sway, heave, roll and pitch degrees of freedom are recorded using oscilloscope. Non contact type displacement sensor is used to capture the variation of displacement with respect to time. The sensor focused laser on the structure and the distance is measured by the reflected ray of the laser. Oscilloscope is used to record the data. Initial displacement is applied on surge, sway and heave degrees of freedom. The free oscillations are recorded. Initial rotation is applied in roll, pitch and yaw degrees of freedom and oscillations are recorded. The average time taken to complete on oscillation is estimated. The obtained results are scaled up to represent the natural period of the prototype.

Based on the study, the natural periods is surge/sway, heave, roll/pitch and yaw degrees of freedom are 19.5s, 2.75s, 27.4s and 50.9s respectively.

It is found that the obtained natural periods are away from the period of sea waves (5 to 18s). Hence, the structure may not experience resonance under wave loading.

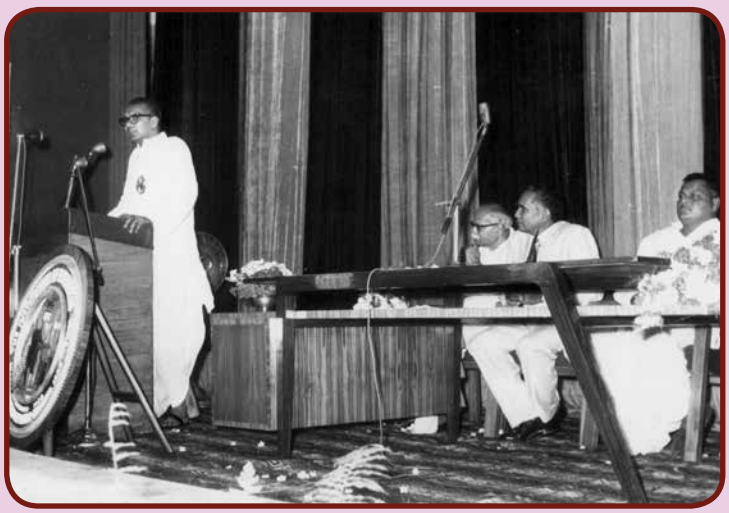
Based on the study, it is observed that the structure is having least natural period of 2.75s in heave DoF which is proving that the structure is highly stiff in heave DoF. It is proving that the structure is following the property of tension leg platform. The natural period in the surge and sway DoF is estimated as 19.5s. The surge and sway natural periods are observed to be equal due to similar stiffness and added mass of the structure. The natural period in surge and sway DoF's is observed as 19.5s, due to the limitation in the water depth in the laboratory. The natural period in yaw DoF is found about 50.9s which is showing least stiffness in yaw DoF. The natural periods in roll and pitch are found similar due to the circular hull, and similar radius of gyration about surge and sway axes.

The present designed tension leg platform can be used to support 5MW capacity wind turbine. The mass distribution of the present designed tension leg platform wind turbine is given in Table 1.

Table 1 Mass distribution of tension leg platform

Description	Mass	Model
	t	Gm
TLP	424.86	384.81
Lower Closure Plate	97.84	132.12
Upper Closure Plate	97.84	132.12
Ballast	6500.00	6350.00
Wind Tower	771.45	610.53
Pretension	1051.12	48.00
Displacement	8943.11	8724.99

Legacy of IEI



Mr B Patnaik, Chairman, Planning Board, Orissa State addressing the Orissa Centre of The Institution of Engineers (India) at the 5th Annual General Meering

Generation of Electricity by Rooftop Air Ventilator and Solar Panels and Monitoring By PLC

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OBJECTIVES

Air ventilators are now used in almost every industries and institutions for the evacuation of exhaust air to the atmosphere. Air ventilators have various benefits like improved air quality, energy savings, and reduction of greenhouse gases emissions. The purpose of our project is to use clean energy (wind) as the source of electricity generation using rooftop air ventilator. As the air ventilator rotates with the wind we will use this principle of rotation for generation of electricity by mounting magnets on the rotary part of the ventilator and windings on the base of the ventilator. Further, the generated output will be used to glow the LED bulbs. PLC will be used for monitoring the ventilators and also measuring parameters like wind speed, rpm and axis. PLCs are used because they are flexible, cost effective, reduces complexity, minimizes errors and easily controllable. Therefore, serving two purposes at same time i.e. ventilation as well as electricity generation. Thus the project

Fitting of ventilator

Actual image of solar panels and pancake type generator

aims at utilizing clean energy for electricity generation with the help of air ventilators and enlightening the power efficient lamps (LEDs). Also the ventilator can work for 24 hours and it can be used to charge the battery during night hours. Thus holding a great importance as compared to solar panels.

ACHIEVEMENTS

Wind power is the conversion of wind energy into more useful forms, such as electricity. Most modern wind power is generated in the form of electricity by converting the rotation of turbine blades into electrical current by means of an electrical generator. Wind energy is considered to be a very clean, cheap and important renewable energy source particularly for rural areas, farms, remote on-shore and off-shore installation away from main electrical grid. It is easy to produce electricity because it is a natural resource which can be used freely and fuels become more expensive.

Axial-flux permanent magnet (AFPM) machines have become an important subject of study because of the development of neodymium magnets over the past 20 years. These machines offer many unique features. They are usually more efficient because of the fact that field excitation losses are eliminated resulting in significant rotor loss reduction. Thus, the machine efficiency is greatly improved and higher power density is achieved.PM machine advantages include lightweight, small size, simple mechanical construction, easy maintenance, good reliability, high efficiency, and absence of moving contacts.

The solar ,wind, water, ocean waves can play important role in production of electricity. But some problems arises in the development of energy power generation like, high construction cost, difficulties in maintenance, space for plant installation and power distribution. India is in the tropical zone. There is high humidity and warm weather present throughout the year. Specially, March, April, May. Because of high intensity of sunlight and high room temperature the ventilation is necessary in workshop's, industries or factory building. Therefore, the rooftop ventilators are used for ventilation purpose because they work without electricity. This technology is popularly installed on the roof in workshop's, industrial buildings, ware houses and also in residences. The main function of this ventilator is that when the air flow on the top of roof or the hot air that lifting under the roof that called ventilator. The ventilator suck the hot air from building and through outside the building and maintain the building temperature. The another function of roof top ventilator is to convert wind's kinetic energy to electrical energy.

Mr Tathagata Roy, Hon'ble Governor of Tripura delivering inaugural address during the 30th Indian Engineering Congress at Guwahati in December 2015

Legacy of IEI

Design and Development of Adiabatic Dehumidification System for Drying Herbal Leaves

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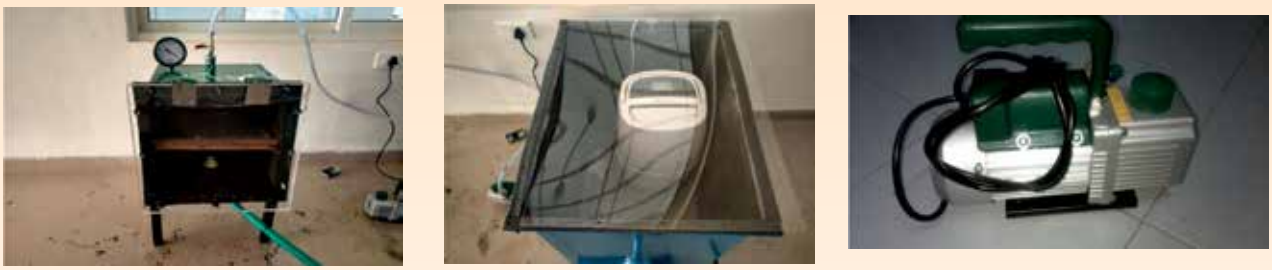
OBJECTIVES

In Ayurveda industries, herbals have to be dried without loss of nutrients and colour. Dried herbal products have been used to make powder and oil for making medicines. Commercially there are many methods for drying herbal leaves. Still they have to encounter many problems such as nutrient degradation, colour loss and power consumption. This could be met by adiabatic dehumidification followed by adiabatic dehydration at vacuum environment. The proposed technique is literally expected to be the most effective in removing the moisture from the herbal leaves provided in no way it will affect the herbal characteristics of the leaves and rate of moisture removed will also be high. The main objectives of the project are i) to develop adiabatic dehumidification system to overcome the problems which are faced by herbal industries. The proposed adiabatic dehumidification system for drying herbal leaves follows two main processes such as vacuum drying and dehumidified air drying and ii) to study the thermal properties i.e., mass transfer rate of herbal leaves with adiabatic dehumidification system. The effect of pressure, temperature of air in moisture diffusion is analyzed theoretically.



Individual component of the project

Assembled component of the project

ACHIEVEMENTS

Adiabatic Dehumidification System is designed and fabricated for the agriculturists those who are cultivating herbals/ herbal processing industries to serve the people. Based on the performance studies, it was found that the proposed system performs better, when performance compared to existing herbal processing systems effectively.

PUBLICATIONS

1. S Mohamed Musthafa, K. Gopinath , S. Balaji, S. Rajakarunakaran and M. Ashok Kumar"Design FMEA of Adiabatic Dehumidification System for Drying Herbal Leaves" Innovation Technology'17" - National Level Paper Presentation Contest conducted by Recruitment Analysis Council at Ramco Institute of Technology on 04.03.2017.
2. S Mohamed Musthafa, K. Gopinath , S. Balaji, S. Rajakarunakaran and M. Ashok Kumar"Mathematical Modelling for Adiabatic Dehumidification System of Drying Herbal Leaves" in "3rd IEI Tamilnadu State Centre Students' & Technicians' Convention & All India Seminar on Innovation, Technology and Knowledge Economy" at K.L.N College of Engineering from 17.03.2017 to 18.03.2017.
3. S Mohamed Musthafa, K. Gopinath, S. Balaji, S. Rajakarunakaran and M. Ashok Kumar "Design and Development of Adiabatic Dehumidification System for Drying Herbal Leaves" Second National Conference on Innovations in Engineering, Science and Technology (NCIEST-2017) at Ramco Institute of Technology from 24.03.2017 to 25.03.2017.

Legacy of IEI

Mr Keshari Nath Tripathi, Hon'ble Governor of West Bengal delivering inaugural address during the 31st Indian Engineering Congress at Kolkata in December 2016

Delamination Analysis in GFRP Composite during CNC Drilling

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GFRP plate

GFRP plate

OBJECTIVES

1) To determine optimal CNC drilling parameter in drilling of GFRP material.
2) To determine the effect of parameter while CNC drilling on composite material.

ACHIEVEMENTS

1) For 15 mm GFRP plate-

- At the entry of the plate de-lamination effect of speed is 26.64% and effect of feed for plate is 26.96% . The optimum CNC drilling parameter are speed-986.54rpm and feed-90 mm/min.
- At the middle of the plate de-lamination effect of speed is 4.25% and effect of feed for plate is 0.09%. The optimum CNC drilling parameter are speed- 600 rpm and feed- 78.52 mm/min.
- At the exit of the plate de-lamination effect of speed is 12.16% and effect of feed for plate is 0.15% . The optimum CNC drilling parameter are speed- 696.96rpm and feed-71 mm/min.

2) For 10 mm GFRP plate-

- At the entry of the plate de-lamination effect of speed is 58.75% and effect of feed for plate is 2.75%. The optimum CNC drilling parameter are speed-600 rpm and feed-72.44 mm/min.
- At the middle of the plate de-lamination effect of speed is 17.38% and effect of feed for plate is 1.54%. The optimum CNC drilling parameter are speed-838.82 rpm and feed-90 mm/min.
- At the exit of the plate de-lamination effect of speed is 2.18% and effect of feed for plate is 6.46%. The optimum CNC drilling parameter are speed- 600rpm and feed-66.73 mm/min.

Smart Health Monitoring System for Elderly Patients using IoT

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Experimental setup

website screen

OBJECTIVES

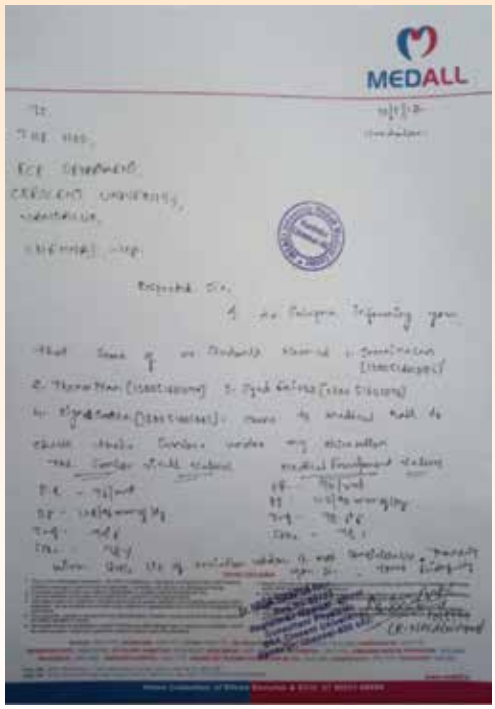
The objective of the proposed work is to design a hardware model which would constantly monitor the health parameters such as pulse rate, oxygen content, temperature, sweating, blood pressure and falling of the patients. These parameters are sensed by the respective sensors and it is then transmitted wirelessly over the internet to a database using IoT technology which would be accessible to the patient's family and doctors. It focuses on monitoring especially the elderly patient's vitals anywhere and at any time. The system also alerts the necessary authorities when there is an emergency. This would help the doctors to monitor and attend multiple numbers of patients at the same time.

ACHIEVEMENTS

The prototype has been tested and validated by the doctors at the medical centre present in B. S. Abdur Rahman University.

PUBLICATION

"IoT Based Elderly Health Monitoring System",Published in SSRG-IJECE, ICRTESTM April 2017.



Design of Down Draught Biomass Gassifier(Lab Model) with Water Spray Type Tar Separator

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OBJECTIVES

- Prepare the down draught biomass gassifier with tar separator using thermal pyrolysis, which can be used as a a setup for the UG & PG level experiments.
- Analysis of factors such a size, shape, type of bio mass and variation of flow of air through the biomass, which are influencing the production of combustible gas.

Wood Pieces to Load in Gassifier

ACHIEVEMENTS

a. Successfully prepared & texted the biomass gassifier (Lab model)

b. From 1 kg of biomass 2.5 m^3 of gas is generated at NTP conditions.

c. Higher velocities or very low velocities of air is not favourable for generation of producer gas. Higher velocities of the air the operating temperature of the combustion chamber will lowered, and no gas will be produced. If the air flow is low leads to complete combustion and it will generates the CO_2 only. When the operating temperature is in between 700°C – 900°C more gas is generated.

d. If oxidation zone is nearer to gas outlet at the gasifier leads to the generation of CO_2 only. Approximately 1 feet distance is required in between these two points.

Biomass Gasifier with tar separator (Prepared)

e. The moisture content and the dust is more in biomass leads to faster generation of tar and some times it may choke the flow of air.

f. This equipment further can be useful for the research in the area of biomass.

PUBLICATION

Presented in "Two day National conference on GREEN and SUSTAINBLE ENERGY-Indian perspective in global Environment(GSEIPGE-2017)" (SERB., DST New Delhi, sponsored conference) on 14th & 15th July,2017 at Aditya Institute of Technology and Management, Tekkali, Andhra Pradesh.

The Institution of Engineers (India)

Fellowship Scheme

under IEI R&D Grant-in-Aid Program

To support purposeful post graduate and doctoral level initiatives, a fellowship scheme has been instituted for students pursuing PG & PhD courses in Engineering for the FY 2017-18. The interested students are requested to follow the guidelines *(https://www.ieindia.org/PDF_IMAGES/R&D/General%20Guidelines_FP.pdf)* and apply as per the format available in our website *www.ieindia.org* so as to reach us latest by October 15, 2017.

Eligibility Criteria:

1) Proposals from Members and Institutional Members will get preference. Please see the guidelines for application of membership *(https://www.ieindia.org/membership1.aspx?accod=memb)* before proceeding with submission of proposal.

2) Preferences will be given to those applications that are industry relevant and that have in-kind or cash support from the industry partners and have potential to lead to an entrepreneurship venture or a start-up model.

3) Thematic focus on green energy, clean water, waste-to-energy conversion, engineering analysis, versatile simulation, environmental impact assessment, urban rejuvenation, skill development in design and manufacturing will be given due weightage.

Quantum of Fellowship:

The quantum of fellowship is @ Rs 10,000/- per month usually for a period of 12 months extendable by six months subsequently for maximum two terms, subject to total duration not exceeding 24 months. Extension may be considered only on valid grounds and the decision of IEI will be final and binding.

The entire amount will be transferred to the account of Principal/ Director/Registrar/Dean (R&D) of the concerned Institute/University who will be responsible for periodic release of the grant to the applicant on a monthly basis. The beneficiary must send 'Monthly Progress Report' *(https://www.ieindia.org/PDF_IMAGES/R&D/General%20Guidelines_FP.pdf)*, duly sealed and signed by competent authorities.

Submission of IEI Fellowship Application:

1. Fill-up the IEI Fellowship Application Form appropriately and send it via email to research@ieindia.org/ieirndcell@gmail.com

2. Please make sure that 2 hard copies of the Application Form duly signed by all concerned along with all supporting documents are to be sent at the following address within 10 days of online submission:

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