TCTD Projects 2020

Tata Centre
for Technology
and Design
IIT Bombay

Education

Energy

Food and Agriculture

Healthcare

Housing

Water

Waste Management

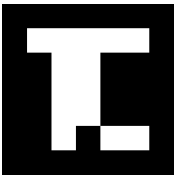
Multidomain

TCTD Projects 2020

ICONS

 Inactive Projects

 White Paper Projects



Tata Centre
for Technology
and Design
IIT Bombay

TCTD Project Booklet January 2020 edition

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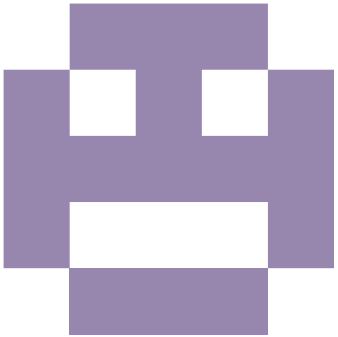


Education

BodhiTree: A platform for improving learning outcomes using online interactive courses and assessed labs

PI: Prof. Kameswari Chebrolu
Co-PIs:
Prof. Varsha Apte, Prof. Bhaskaran Raman
Dept. of Computer Science & Engineering

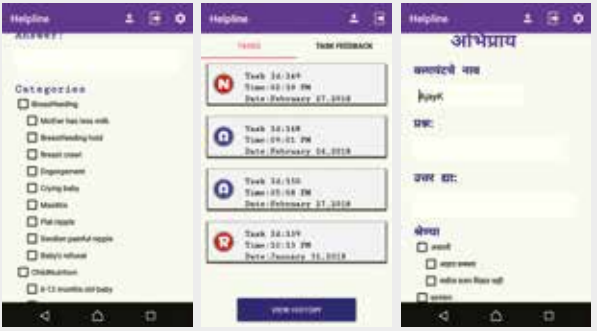
The BodhiTree solution aims to offer a compelling and feature-rich online platform for hosting of multimedia interactive books with associated auto-graded, or grading-assisted exercises and labs, which can be adapted as courses in a customized manner by local college instructors, or taken independently by students. With continuous (auto) assessment and lab support, this interactive platform would be a revolution in the context of student-learning and effective teaching, especially in higher education, in settings with poor teaching infrastructure.

Accessible and affordable digital learning aids for children in rural communities

PI: Prof. Jayesh Pillai, IDC School of Design

The proposed solution would be reusable in terms of hardware by multiple standards within the same school, and customizable/ reusable in terms of software across multiple devices. This allows for collaborative learning as well as access to study content beyond the scope of the school premises. To bring in simplicity in use of technology, Augmented Reality (AR) based learning aids are to be introduced to the students. The project will focus on the qualities of AR to enhance the learning experience of the tribal/rural students.

VMOCSH: Voice based mobile crowd sourced helpline



PI: Prof. Kameswari Chebrolu
Dept. of Computer Science & Engineering

The goal of this project is to create a generic "voice-based mobile-crowd-sourced helpline" that can provide similar access to information. The same helpline can cater to a variety of information needs in different domains such as health, education, agriculture, judiciary, finance etc. The planned helpline is asynchronous, based on mobile crowd-sourcing, voice-based and utilizes the services of all, independent of literacy level or tech suaveness. The helpline aims to provide access to information for a population that is illiterate and poor.

Spoken language training on mobile device

PI: Prof. Preeti Rao
Dept. of Electrical Engineering

A shortage of teachers and absence of speaking opportunities outside school contribute to a lack of practice in spoken English for children in rural schools. The project seeks to alleviate the problem by targeting an affordable and scalable technology solution that can help struggling learners with automatic means to obtain immediate feedback on pronunciation and fluency. The automatic assessment system is developed using a large dataset of oral reading recordings from the target group of children of various proficiency levels as annotated by human experts.

A digital aid for language (Hindi) teaching and learning

PI: Prof. Malhar Kulkarni
Dept. of Humanities and Social Sciences
Co-PIs:
Prof. Pushpak Bhattacharyya
Prof. Preethi Jyothi
Dept. of Computer Science and Engineering,
Prof. Aniruddha Joshi, IDC School of Design

In this project, the Hindi WordNet data is remodelled to suit the school teaching and learning environment. The WordNet information is displayed in a layered manner suitable for students of lower classes up to the higher level, each layer capturing the right level of abstraction. This platform will help to teach and learn vocabulary and grammar of the Hindi language, and will also serve as a dictionary and thesaurus, with audio-visual input.

Active learning in electronics and power electronics with simulation app

PI: Prof. Mahesh Patil
Co-PI: Prof. Suryanarayana Doolla
Dept. of Electrical Engineering

Active learning, in which students learn by participating in an activity in the class, is known to be more effective than the traditional method where students are passive recipients of knowledge being presented by the teacher. In this project, a mobile app has been developed to promote active learning in the areas of electronics and power. The app is based on the circuit simulator SEQUEL developed at IIT Bombay and is meant for engineering and BSc students. It allows the user to simulate specific circuits and also to change circuit parameters and view their effect on circuit performance.

TCTD Chemplay

PI: Prof Sanjay Mahajani,
Dept. of Chemical Engineering

TCTD Chemplay, a kit of educational games to help students from Class VII and VIII understand Chemistry in an interactive manner. The kit attempts to drive home principles about elements, compounds and properties of the periodic table elements. Conceptualized by Dr Nitin Bhate, Mrs. Pradnya Gokhale and Mrs. Shalini Kumar, and designed and fabricated by the team at TCTD, It is published under a CC BY-NC-ND license.

LETS Learn English through stories

PI: Prof. Alka Hingorani, IDC School of Design
Co-PI: Prof. Arti Kalro, Shailesh J. Mehta School of Management

The project aims at facilitating English language learning in resource constrained environments through engagement with stories written and illustrated by the children themselves. There are two primary motivations for this project, one, to reinforce the role of children as content creators rather than mere consumers, and two, to enable learning outside of a structured English language classroom. At the present time, 16 story books at three graded levels each are in print stage. The project is intensely collaborative, melding art and language and literature in ways that turn accepted relationships—teacher/learner, creator/consumer—on their heads.

Telling it together: Collaboration between designers and craft communities

Prof. Nina Sabnani, IDC School of Design

The Bhil community has a rich resource of oral narratives that remains untapped and unknown. There is potential for collaboration to create multiple media artefacts to develop new audiences and economic opportunities for this community. The objective is to engage and collaborate with the Bhil community of Madhya Pradesh that has its own unique form of painting and narratives, and can be transformed into designed media artefacts like films, board games, mobile apps, merchandize and books for e-learning through digital media. This is to create opportunities for craft development and craft awareness.

Energy

Adjustable thermoelectric power generator belt for rural communities

PI: Prof. Sudarshan Kumar
Co-PI: Prof. Asim Tewari
Dept. of Aerospace Engineering

The proposed solution is an adjustable and portable thermoelectric generator belt which can be placed around any heated device and can generate enough electricity to power up a Led lamp or charge a mobile phone. Since households in the rural areas use chulhas for cooking thrice a day, they can place it around their stoves or heated vessels to utilize the wasted heat energy and generate electricity. Due to its adjustable design, it can be placed on any kind of stove or vessel without replacing the conventional chulhas. It is independent of weather conditions and requires low maintenance unlike other renewable energy solutions.

Low cost and efficient air conditioner for mushroom cultivation & solar dryer for post harvest processing of mushroom

PI: Prof. Milind Rane
Dept. of Mechanical Engineering

TCTD has already spent one year in developing and pre-testing its innovative and training methods on oyster mushroom cultivation with one SHG in Modgaon. The present project aims to conduct a pilot with eight SHGs in Modgaon. The pilot will help establish the production (solar assisted humidifier) and small processing units (solar dryers), initially two systems each of solar assisted air conditioners (humidifier based) and solar dryer will be developed, one unit of each will be placed in IIT Bombay for research and the second unit of each will be deployed in the field. After successful field demonstration, the proposed technology is expected to serve as a model to be adopted by marginal farmers and tribal communities for mushroom cultivation.

Design of puncture proof tires and tubes

PI: Prof. Mahesh S Tirumkudulu
Co-PIs:
Prof. Vinay A Juvekar, Prof. Jyoti R Seth
Dept. of Chemical Engineering

Tire puncture is a common occurrence on Indian roads and solutions to reduce its occurrence under existing road conditions is a challenging task. One of the approaches to its mitigation is the use of tire/tube liquid sealant. The project proposes to design/synthesize tire sealants, for tube and tubeless tires, that is economical, seals holes greater than 8 mm (preferably 9 mm) and has an operating temperature range of -- 50^{o}C to 80^{o}C and must continue to function through the lifespan of the tire. These will be extensively tested on tires and tubes before embarking on commercialization.

Design, development, and testing of aerogel-based steam generation system and solar cooker

PI: Prof. Anish Modi
Co-PIs: Prof. Shireesh B. Kedare
Dept. of Energy Science and Engineering
Prof. Evelyn Wang, Device Research Laboratory,
Dept. of Mechanical Engineering, MIT, USA

The project proposes to develop a low concentrating compound parabolic concentrator based non-tracking solar thermal system, with simple copper-finned tube absorber, having a selective coating typically used for flat plate water heaters, but with low conductivity glazing made of aerogel with high transmissivity for optical wavelengths and low transmissivity for thermal (infrared) wavelengths. This kind of aerogel is presently developed and tested at MIT Boston which seems to be a suitable affordable solution.

Design and development of box-cooker equivalent solar PV powered electric cooker for indoor applications

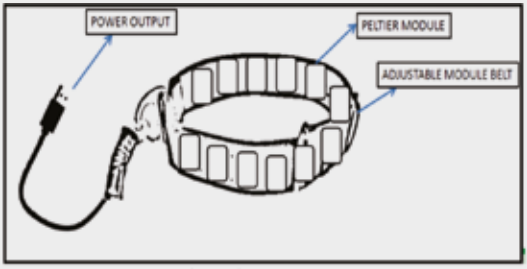
Heating element

Heating with heat transfer material

PI: Prof. Chetan Singh Solanki
Dept. of Energy Science and Engineering
Co-PI: Prof. Jayendran Venkateswaran
Industrial Engineering & Operations Research

The project proposes to develop solar electric cookers, with integrated insulated vessels in order to reduce required power and the associated costs. This solar electric cooker can be used for cooking by boiling. Designed to generate electricity with Solar PV modules, the PV powered electric cooker will be modular in design to fulfill the cooking needs of various quantum. The design uses resistive circuit for cooking by boiling, which uses low power.

Adjustable thermoelectric power generator belt for rural communities

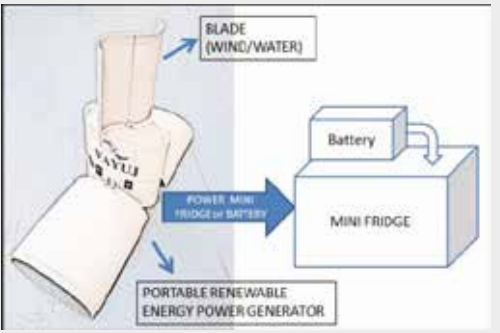


Sketch of proposed module

PI: Prof. Sudarshan Kumar
Co-PI: Prof. Asim Tewari
Dept. of Aerospace Engineering

The proposed solution is an adjustable and portable thermoelectric generator belt which can be placed around any heated device and can generate enough electricity to power up a Led lamp or charge a mobile phone. Since households in the rural areas use chulhas for cooking thrice a day, they can place it around their stoves or heated vessels to utilize the wasted heat energy and generate electricity. Due to its adjustable design, it can be placed on any kind of stove or vessel, without replacing the conventional chulhas. It is independent of weather conditions and requires low maintenance unlike other renewable energy solutions.

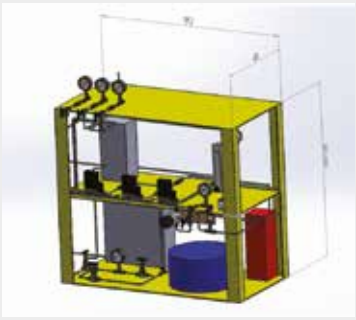
Mini storage system for vaccines/ medicines in rural India using renewable energy resource



PI: Prof. Asim Tewari
Co-PI: Prof. P Kumaresan
Dept. of Aerospace Engineering

The solution is a portable renewable energy powered mini storage system which is lightweight and can be carried by health technicians easily in their bag-pack. This mini storage system will have temperature feedback control mechanism. It will also generate warnings if temperature goes below prescribed temperature range for that particular vaccine/medicine. This will help users to identify whether the vaccine has crossed its usage limits. This system will be renewable energy powered (wind or water) so that operation will not be electricity-dependent.

Moist membrane based technology for biogas upgradation



PI: Prof. Jayesh Bellare
Co-PI: Prof. A. K. Suresh
Dept. of Chemical Engineering

Biogas technology is currently being widely utilized in India and across the globe. But most of the technologies are not scalable and require huge space. In the present work, a hybrid process based on membrane separation and water absorption is selected for biogas conditioning. Novel hydrophilic membranes will be developed to enhance the CO_2 separation performance of water swollen membranes, in this project. The research is expected to result in reduction in use of petroleum based fossil fuels such as petrol, diesel, and LPG, leading to monetary and environmental benefits.

Developing a context appropriate treadle pump for irrigation of small farms in a tribal region of Palghar district

PI: Prof. Deepak Marla
Co-PI: Prof. Upendra Bhandarkar
Dept. of Mechanical Engineering

In the tribal belts of Konkan region in Maharashtra, marginal farmers from a number of villages largely depend on treadle pumps for manually irrigating their farms. However, there exist only a few designs that are manufactured and sold worldwide. This project aims to design and develop an optimal pump for tribal farmers in the hilly regions through a synergistic approach involving analytical modeling of the treadle pump and field-level testing.

Study on local solar entrepreneurship in India: Mixed method approach

PI: Prof. Jayendran Venkateswaran
Industrial Engineering and Operations Research
Co-PI: Prof. Chetan Singh Solanki
Dept. of Energy Science and Engineering

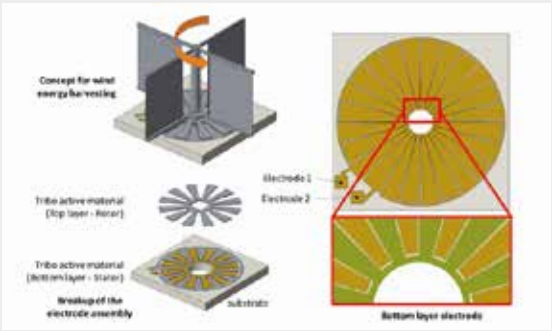
This white paper proposal aims to quantify and analyze the dynamics of solar entrepreneurship for solar energy access by using a mixed method approach. The proposed work will identify the impact of skill-development of locally trained solar entrepreneurs on their livelihood opportunities and key barriers or facilitators for locally trained solar entrepreneurs. This study will suggest prospective measures at the policy level that may be used by various solar products dissemination programs.

Assessment of acceptance levels of potential solutions disseminated through participatory & non-participatory approaches for rural development

PI: Prof. Anish Modi
Co-PI: Prof. Shireesh B Kedare
Dept. of Energy Science & Engineering

This white paper project aims at quantifying and analysing the difference between the social acceptance levels of the various technological solutions disbursed through the participatory and the non-participatory approaches. Through detailed field surveys and impact assessment studies, the learnings and guidelines may be used by various improved-chulha dissemination programs, to significantly increase the probability of their success.

Triboelectric generators (TEG) for wind energy harvesting



PI: Prof. Dipti Gupta
Dept. of Metallurgical Engineering & Materials Science

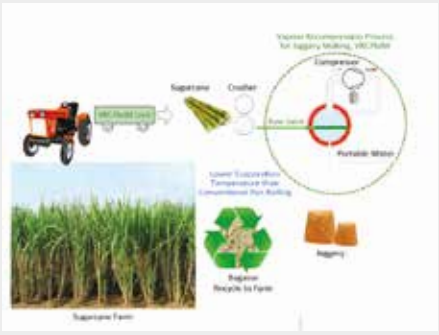
In this project, this energy crisis for the larger population is addressed by designing a budget friendly, sustainable, zero emission, portable energy harvesting device which should sufficiently charge any small electronic gadget, like a mobile phone by extracting energy from the ambient energy sources around us. The proposed wind energy harvesting devices targets a vast range of population from every income range, location, gender, age and health condition.

Development of indigenous screen-printable silver paste for solar PV

PI: Prof. Parag Bhargava
Dept. of Metallurgical Engineering & Materials Science

Silver paste - used for the front contacts in the solar cell – is the second most important and costly raw material component in solar cell manufacturing, after the silicon wafer itself. India at present imports several tons of silver paste annually. High dependence on imports makes solar cell manufacturing in India totally uncompetitive. This project studies the possibility of developing this paste indigenously, which would then secure the supply chain for solar cell manufacturing in India.

Energy efficient jaggery maker



PI: Prof. Milind V. Rane
Dept. of Mechanical Engineering

Development of small capacity energy efficient mobile jaggery makers can improve the economics of jaggery production, eliminate the transportation of sugarcane, improve the working conditions of the operators, improve the quality of jaggery, and reduce the space and cost required to setup a jaggery unit. The proposed vapour recompression system will eliminate bagasse firing altogether and recover potable water.

Compact efficient modular water based biogas scrubber

PI: Prof. Milind V. Rane
Dept. of Mechanical Engineering

Raw biogas mainly consists of CH_4, CO_2 and a trace amount of H_2S. It is desirable to scrub CH_4 and H_2S to enhance the utility of the biogas and its use as Bio-CNG. The objective of the current work is to develop a cost effective, modular, scalable rotating disk based mass exchanger which could scrub CO_2 at near atmospheric pressure and produce bio methane for use in different applications such as running engines, compressing and bottling in the form of Bio-CNG and household cooking gas. The design of the laboratory prototype and die for disks for PP are ready. The integration of the first unit is underway.

Design and fabrication of power electronic controllers for certain home appliance motors

PI: Prof. Vivek Agarwal
Dept. of Electrical Engineering

Single phase induction motors are extensively used in home appliances. Suffering from drawbacks such as poor efficiency, poor power factor (PF) at the source, low power density and noise, they require the utility to spend large amounts of money for compensation. This project intends to design effective and efficient power electronics for novel AC motors that have been proposed by researchers at MIT for applications in home appliances, leading to compact, high PF, high efficiency, low noise systems.

Low cost and rugged solar PV microinverter

PI: Prof. Vivek Agarwal
Dept. of Electrical Engineering

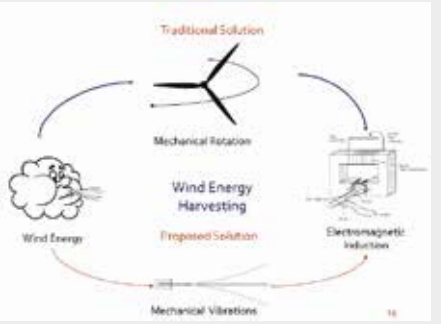
Microinverters are low power grid connected or stand-alone inverters having the potential of high efficiency, compactness, high reliability and high economy in terms of meeting energy needs of small installations. e.g. rural areas, homes, small industries etc. They are electrically safer, and render themselves to modularity, scalability and mass production along with easy fault monitoring. This project proposes to build highly reliable, compact microinverters with remote monitoring. These will be suitable for both grid connected systems and stand-alone applications, attempting to conform to Indian grid connections.

Rural and urban employment generation to cater to potential e-cycle market opportunity in India

PI: Prof. Arindrajit Chowdhury
Dept. of Mechanical Engineering
Co-PI: Prof. Debraj Chakraborty
Dept. of Electrical Engineering
Sujay Sirur (Eaton), External Consultant

Developed as a kit, the proposed electric bicycle can create employment for semi-urban and rural youth, as well as promote cost-effective means of transportation for the lower strata of the society. The existing kits can be redesigned (likely from bottom-up) to customize for Indian conditions. Developing features that are important to Indian customers and reducing or sharing the ownership/operating costs by using innovative means are the key areas to be worked upon.

Flutter based wind energy harvesting



PI: Prof. V. Kartik
Dept. of Mechanical Engineering

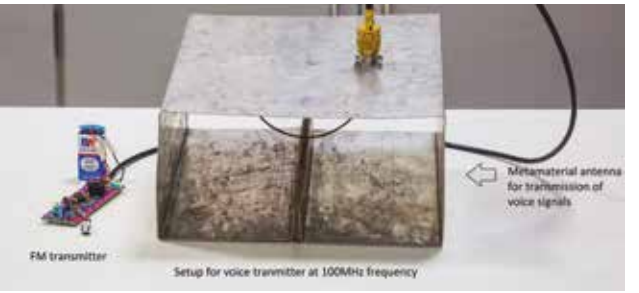
Inspite of wind being an abundant source of renewable energy, the effective conversion of wind energy to a usable form has remained a challenge. Wind excited vibrations (Flutter) can be used as an alternative to the rotary-based wind energy generator. Issues related to sensitivity with respect to wind direction and magnitude can be mitigated with flutter-based harvesting. This project looks at such a mechanism which can address the issue of small-scale applications. This has potential to provide better access of renewable energy to individuals and small businesses in the low income group.

Modular mass transit using platoons of battery assisted human powered vehicle

PI: Prof. Debraj Chakraborty
Dept. of Electrical Engineering

Most of the mass transit systems in Indian cities are limited in reach, frequency and comfort. Unless extremely fortunate, a typical commute requires complementing mass transit vehicles. This has led to widespread obesity and related lifestyle diseases. This project aims to develop a modular electricity-assisted human-powered mass transit system which should address challenges such as unhealthy air quality, congestion and associated evils.

Through the earth communication for underground mines



PI: Prof. Jayanta Mukherjee
Dept. of Electrical Engineering

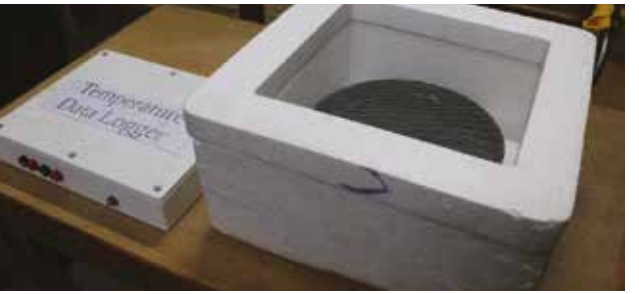
It is essential to deploy a good communication system inside mines. In order to enhance rescue operations during mining accidents, the information about the trapped miners and the exact location of the accident is very essential. This project proposes a communication system in which the waves can travel through the earth. The objective of the project is to make a high sensitivity receiver working at 1MHz. After manufacturing this high sensitive receiver, 1 MHz antenna is required to be designed and manufactured.

Development of coloured cool coatings

PI: Prof. Anand Khanna
Dept. of Metallurgical Engineering & Materials Science

In this project, the development of 'cool paints' shows great potential in reducing the thermal discomforts for people and cutting down on the costs incurred on air-conditioners. The cool paints that are being developed give substantial difference of temperature after applying to the surface. The cool paints will have dark coloured Near Infra Red (NIR) reflecting/ cool pigments. The NIR reflective base coat and cool topcoat will be formulated by the combination of IR reflecting pigments, which deflect IR radiation.

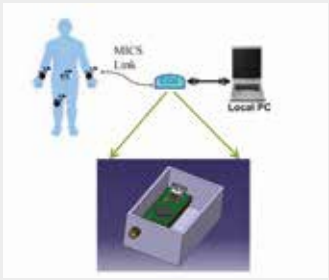
Icemaker: Making ice without electricity using nocturnal radiative cooling



PI: Prof. Dipankar
Dept. of Electrical Engineering

The project proposes to build and characterise a low-cost ice-maker using nocturnal radiative cooling. It does not use any external energy (electricity or otherwise). The projected cost, if manufactured in large numbers, could be as low as a few hundred rupees per unit. The intended target is remote populations at the bottom of the economic pyramid. The ability to create ice, and therefore, refrigeration processes could have large impact in food-preservation and storage, medical refrigeration, etc.

Low-power transceivers for wireless communication



PI: Prof. Jayanta Mukherjee
Dept. of Electrical Engineering

The project aims at developing a low power transceiver for wireless communication which would find potential use in biomedical applications. Currently, a framework is being developed for the comprehensive testing of the fabricated chip. The receiver front-end and Intermediate Frequency (IF) stage for Medical Implant Communications Service (MICS) band has been designed. This band is dedicated for wireless communications associated with implanted medical devices, achieving reduced power consumption. Post testing, the system consisting of the receiver and auxiliary circuits (primary prototype) would be developed.

Food and Agriculture

Development of on-farm micro cold storage

PI: Prof. Amit Arora
Centre for Technology Alternatives for Rural Areas
Co-PI: Prof. Milind Rane
Dept. of Mechanical Engineering

The project team aims to evolve possibilities for value generation which could be imagined in the form of better income of farmers through interventions such as development of on-farm standalone micro cold storage system to minimize post-harvest losses of horticulture produce. Such systems are to be built as affordable solutions for individual farmers as well as the farmers' community. On-farm storage solutions scale down the concept of large scale refrigeration to protect perishables against spoilage before they reach the market.

Smart warehouse

PI: Prof. Santosh Noronha
Dept. of Chemical Engineering

The project team proposes to develop a smart warehouse solution to monitor the quality of a specific produce, such as onions, by deploying a sensor network which monitors environmental parameters and gas composition, and which triggers and communicates alerts as appropriate. The smart warehouse solution to curb the loss of stored produce will greatly benefit those at the bottom of the pyramid in the agricultural sector.

Financial analysis of agrarian families to identify the crisis in agrarian society

PI: Prof. Bakul Rao
Centre for Technology Alternatives for Rural Areas
Co-PI: Prof. Shireesh B Kedare
Dept. of Energy Science & Engineering

Agrarian crisis in India is being reflected in terms of farmers' suicide, indebtedness, vulnerable market condition, susceptible weather, and reduced agriculture production. The aim of this white paper study is to understand the financial pattern of marginal agrarian family for identifying the problems of allocation and priority of expenditure. The proposed work is to empower marginal farmers in identifying the area of concern and thereby help in better decision making and developing better policies for long-term improvement in agrarian crisis.

Does inefficient agriculture supply chain cause 'distress sale'? Learnings from the experience of Maharashtra

PI: Prof. Vinish Kathuria
Shailesh J. Mehta School of Management

There is a gap between promoting agriculture as a principal source of livelihood and the mechanisms to ensure remunerative prices to farmers' produce, on a sustained basis. It is relevant to study to what extent the inefficiencies in the agriculture supply chain influences "distress sale" of agriculture produce. This study integrates a value chain based approach and consequently suggests interventions to mitigate the existing inefficiencies around the functional areas, corresponding to production, distribution, processing, and marketing of agricultural products.

Evaluation of the performance of traditional seed storages and design and development of seed storage system for community level seed banks and marginal farmers

PI: Prof. Upendra Bhandarkar
Dept. of Mechanical Engineering
Co-PI: Prof. Narendra Shah
Centre for Technology Alternatives for Rural Areas

The present study is to evaluate the performance of the existing seed storage methods conducted by the farmers, and design and develop a low cost, seed conservatory for marginal scale farmers and community level seed banks.

Value addition of cashew apple through processing and preservation

PI: Prof. Amit Arora
Centre for Technology Alternatives for Rural Areas

To explore the full potential of cashew apple juice, the knowledge of its processing and preservation methods is essential. There is a need to develop a technique which is clean, safe, easy to handle, rapid, less energy-intensive and cost effective, where the processing does not affect the quality of the product. The present project is proposed to develop an integrated process (pre-treatment assisted membrane separation process) which can help improve the shelf life of the cashew apple, and simultaneously minimize the astringency of the produce.

Study of pre-treatment (bio-chemical and steam) of cotton-stalks for beneficiation as animal-feed

Cotton stalk sample

PI: Prof. Madhu Vinjamur
Dept. of Chemical Engineering
Co-PIs: Prof. Narendra Shah
Centre for Technology Alternatives for Rural Areas
Dr. Suhas Zambre, TCTD

The combined effect of bio-chemical and physical methods are needed to convert agri residue into animal feed and for the "in-vitro" testing of the nutrition impact of pre-treatment of cotton-stalks. In this project, in-vitro tests have indicated that the former method improved digestibility significantly compared to untreated cotton stalk. The latter method is being investigated for its efficacy of the bio-treatment on beneficiation of cotton stalk as animal feed.

Feasibility study of jaggery making and related products

PI: Prof. Sanjay Mahajani
Dept. of Chemical Engineering
Co-PIs: Prof. Narendra Shah
Centre for Technology Alternatives for Rural Areas
Prof. Vinish Kathuria
Shailesh J. Mehta School of Management

For the past years, jaggery – a nutritious sweetener - is being manufactured in the same unorganized way in cottage industries. This conventional process of jaggery making is labor dependent, unhygienic, has no technology interventions made, and does not ensure a quality product. The project team has developed a continuous process to produce jaggery at a scale of 1 ton/day. This process would ensure consistent product quality with minimum labor requirement.

Technology needs assessment and identification for intervention for a block, Maharashtra

PI: Prof. K. Narayanan
Dept. of Humanities & Social Sciences

This study aims to spell out the technological, marketing and other institutional requirements of various socio-economic groups in the chosen rural area. Attempts would also be made to incorporate the proposed support under the existing schemes of the government, local bodies, and other agencies in the area of rural development. The socio-economic benefits arising from extending such support to the target groups would also be examined as part of this project.

Enabling livelihood generation in tribal & marginal farmers through a commercialization project on utilization of agro residue to grow edible mushrooms

PI: Prof. Sanjay Mahajani
Dept. of Chemical Engineering

This solution of mushroom cultivation aims to help marginal farmers in becoming micro entrepreneurs by converting their agricultural wastes into high quality mushrooms. A robust protocol has been developed at IIT Bombay, based on the learning from past cultivation failure studies. The project uses locally available resources such as agro residue and lime, which are low cost and abundant, and outlines a sustainable approach for entrepreneurship development.

Ergonomics assessment and design intervention on removing drudgery in jaggery making

PI: Prof. Narendra Shah
Centre for Technology Alternatives for Rural Areas
Co-PIs: Prof. G. G. Ray, IDC School of Design
Prof. Sanjay Mahajani
Dept. of Chemical Engineering

The project aims to remove drudgery in the production processes of jaggery-making, and design and test the prototypes of assistive aids to reduce the workers' hardships. For a labour-intensive industry providing employment to millions in the rural sector, one of the areas that needs considerable improvement is making the process labour-friendly. The objective of this study is to test the solutions possibly in working units to address the labour shortages.

Design and development of deshelling process for marking nut

PI: Prof. Upendra Bhandarkar
Dept. of Mechanical Engineering

This project proposes an efficient and mechanised de-shelling process of Bibba, the marking nut. It focusses on ensuring safety and a high rate of shelling without wastage, and easing out the prolonged manual de-shelling process which has led to oil spills, blisters on the skin, and back and neck ache. Five different de-shelling devices have been developed to reduce the physical pain, drudgery and to improvise the de-shelling process. The objective has been to develop a better technology thus improving the livelihood of tribal women working in this with the de-shelling of the marking nut.

Healthcare

Development of a minimally intrusive passive assistive device (MIHELP) for giving mobility assistance to elderly people

PI: Prof. Anirban Guha
Dept. of Mechanical Engineering
Co-PI: Prof. Neeta Kanekar
Dept. of Biosciences & Bioengineering

A simple passive assistive device for enhancing mobility in this population is a huge opportunity and will be so in the coming years as well. The project team proposes to develop a proof-of-concept device with a lower level of complexity than the existing devices. The device will be designed such that the pre-stress in the spring(s) can be easily adjusted, so that a near optimal assistance is given to the person depending on his/her anthropometric and gait characteristics.

Cognitive markers of ADHD subtypes: Development of a diagnostic tool

PI: Prof. Rashmi Gupta
Dept. of Humanities & Social Sciences

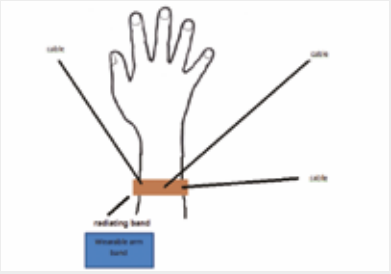
The current proposal will be highly helpful to build the world's first-ever objective tool to provide a solution to the problem of misdiagnosis of children with Attention Deficit Hyperactivity Disorder (ADHD) and its subtypes. It will provide the web/app-based innovative and affordable tool to classify ADHD subtypes, which will tap cognitive-motivational mechanisms impaired explicitly in ADHD subtypes. Such a diagnostic system will provide the clinician with objective data based on the child's actual performance and will allow for observation in a paradigm likely to elicit inattention and impulsiveness.

Development of a sensitive blood-based biochemical assay for diagnosis of Parkinson's disease at the pre-motor stage

PI: Prof. Samir Maji
Dept. of Biosciences & Bioengineering

This project aims to develop a sensitive biochemical blood-based assay to diagnose Parkinson's disease (PD), well before the clinical manifestations. This assay would be based on detection of the disease-associated protein aggregates leaked from the brain into the circulating blood stream. The objective is to amplify them in a test tube using technology based on the principle of polymerase chain reaction. The technique would involve the use of a novel substrate (developed in our laboratory) for amplification of these protein aggregates. The study would be helpful in defining the critical concentration range of protein aggregates present at various stages of PD. Using this highly sensitive and specific assay, a gold-standard diagnostic test would be available for PD detection at early stages.

Non-invasive blood glucose monitoring using EM waves



PI: Prof. Jayanta Mukherjee
Dept. of Electrical Engineering

It is proposed to develop a system which is non-invasive, does not need materials to be replenished and can monitor blood glucose continuously. The aim is to achieve this by monitoring the dielectric constant of the blood continuously by measuring the reflection and transmission of electromagnetic waves through the human arm. A change in blood glucose levels causes a change in the dielectric constant of blood. The proposed method of blood glucose monitoring will involve measuring change in the blood dielectric constant due to changes in glucose concentration.

Affordable tinnitus detection device and affordable tinnitus treatment - E medicine

PI: Prof. Maryam Shojaei Baghini
Dept. of Electrical Engineering
Co-PI: Mr. Neeleshkumar Pandit, Project Staff

Tinnitus is an auditory perception without the presence of an external sound. It has a demoralizing impact on the sufferer in terms of quality of life. In order to help tinnitus patients several intervention techniques have been propounded. However, no single treatment approach is successfully reducing the tinnitus symptoms. The present proposal is an attempt to develop affordable tinnitus detection device and multimodal treatment approach to treat tinnitus patients. Multimodal treatment has not yet been explored for tinnitus management.

Automated aid for screening of oral cavity lesions – A feasibility study

PI: Prof. Amit Sethi
Dept. of Electrical Engineering

The project team proposes to determine the feasibility of developing a smartphone app powered by artificial intelligence (AI) to flag candidates for biopsy of oral cancer, on which a primary healthcare worker can be trained in a few hours. The idea of a smartphone app has been zeroed in upon due to the ready availability of smartphones with cameras and LED lighting to take images of the oral cavity. Using an app with a computationally light AI-based inference engine or by transmitting images to a heavy-duty AI inference server over the mobile network will be the backbone of a subsequent affordable and scalable solution.

Development of multisensory technique for intervention of developmental dyslexia: an electrophysiological and behavioural approach

PI: Prof. Azizuddin Khan
Dept. of Humanities & Social Sciences
Co-PI: Prof. Abhishek Gupta
Dept. of Mechanical Engineering

Multimodal treatments are effective in improving dyslexic symptoms. Researchers have used phonological and visual modalities together, but there is a dearth of intervention techniques using tactile modality. The present project aims to develop a multimodal technique as an intervention technique. Haptic intervention, through virtual reality interfaces, for treatment of dyslexia has not been explored. The solution should be affordable as subjects can visit a central training facility for treatment.

Experimental study to evaluate emissions from cook stoves using solid fuels with a focus on reduction of exposure

PI: Prof. Virendra Sethi
Environmental Science & Engineering Dept.
Co-PIs: Prof. Upendra Bhandarkar
Dept. of Mechanical Engineering
Prof. Satish B Agnihotri
Centre for Technology Alternatives for Rural Areas
Prof. Shireesh Kedare
Dept. of Energy Science & Engineering
Svati bhogle, External Consultant

The study will take a pragmatic approach to match locally available solid fuels with various designs of cook stoves that are prevalent in India. The matching and fine tuning is intended to lead to decreased emissions, and thereby reduce the exposure to smoke and CO in kitchens. Further, cook stoves contribute to the local ambient air pollution, and quantification of such emissions is essential to assess the relative importance to be attributed for mitigation measures. The proposed work is intended to address reduction of air pollution levels from this basic human activity.

Smart phone based remotely excited flexible microwave resonator patch array prototype development for high resolution dielectric contrast mapping of skin tissue

PI: Prof. S.P. Dattagupta
Dept. of Electrical Engineering
Co-PIs: Dr. Sanjeeva Srivastava
Dept. of Biosciences & Bioengineering
Dr. K Tuckley, Dept. of Electrical Engineering

The objective is to develop low-cost, low-maintenance prototype unit that can provide real-time, high resolution dielectric contrast mapping of skin tissue. The flexible patch design ensures ease of placement on contoured surfaces (for example, breast). Smart phone based operation is to enable plug and play operability suitable for remotely located primary health-care centers. The primary target will be populations in rural and suburban areas where there is uneven access to (skin tissue) scanning facilities.

Translation to pre-clinical and clinical trials of low cost bone and near net shape graft for dental and orthopedic bone reconstruction

PI: Prof. Jayesh Bellare
Dept. of Chemical Engineering

A novel 3D scaffold has been developed and is being further tested. The aim in this translational project is to provide an effective treatment for the base of the pyramid by bringing the cost to at least 10 times lower than other products available, allowing penetration of these products to the lives of people having low incomes. The technology will be customized to every patient of any age and will be able to repair large and complete restoration of bone structure, for dental and orthopedic conditions.

A mobile phone microscope with applications in point-of-care diagnostics and health education

PI: Prof. Debjani Paul
Dept. of Biosciences & Bioengineering

Taking the microscope to the field will make the process of detection and diagnosis rapid. The prototype which has been developed is a portable all-in-one system which can display, magnify, capture, store and transmit high resolution slide images. The current project focuses on translating a laboratory prototype of the mobile microscope, into a market-ready device. It also involves validating it with a large number of clinical samples in field settings, with special focus on malaria and sickle cell disease.

Billiscope: Jaundice detection in neonates

PI: Prof. Soumyo Mukherji
Dept. of Biosciences & Bioengineering

Monitoring of neonatal jaundice, a highly prevalent condition in new-borns, requires frequent monitoring of bilirubin levels. Using the multi-spectral imaging technique, this translated project has developed the Biliscope which can estimate the amount of bilirubin, and remove confounding effects of skin tone, blood flow etc. The handheld device combined with a mobile app which supports a one-touch workflow, attempts to report a relative hyper-bilirubin measurement, on an NICU-friendly interface.

Upliftment of nutritional status of vulnerable population in Dharavi slums of Mumbai

PI: Prof. Narendra Shah
Centre for Technology Alternatives for Rural Areas
Co-PI: Prof. D. Parthasarathy
Dept. of Humanities & Social Sciences

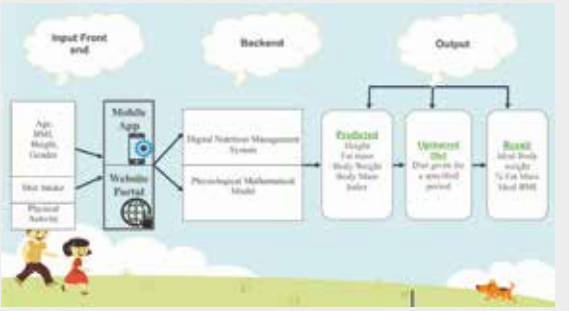
This project plans to create a sustainable solution that studies food-habits, tastes and develops formulations that can be supplied to selected Anganwadis in identified locations, to address malnutrition in children. Undertaken with 3 other institutions – Pediatrics Dept (Sion-Hospital), SNEHA (Mumbai based NGO) and the CDPO- ICDS office in Dharavi block, Maharashtra, the project outcome will be useful in devising strategies in addressing malnutrition by the public health machinery.

Development of a telepathology framework

PI: Prof. Santosh Noronha
Dept. of Chemical Engineering

This project is developing an ecosystem for training pathologists in remote locations and to facilitate communication between rural and urban laboratories. This web-based application lets a senior pathologist hold a training session without gathering all students in one place. It can also be used to share complicated cases between different pathologists for second opinion. This will enable more comprehensive discussion on the case in hand and faster diagnosis for patient.

Digital automated wellness management platform for Indian infants and children



PI: Prof. Kareenhalli Venkatesh,
Dept. of Chemical Engineering

The project proposes a physiological mathematical model that captures the effect of lifestyle on the health of Indian children. This model is implemented digitally through a web portal and a mobile app which can be used to collect data, predict the health status and advise lifestyle interventions towards wellness management in Indian children. The model and quantification methodology developed can also be useful to create protocol to manage wellness in kids.

Microcrystalline silicon piezo-resistive sensor for wide ranging pressure applications - PHASE - II

PI: Prof. Rajiv Dusane,
Dept. of Metallurgical Engineering & Materials Science

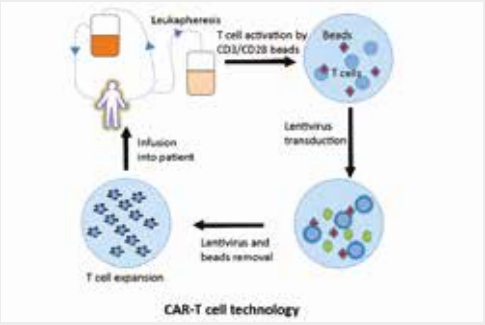
The most important component of the plantar pressure measurement is the sensor. The project aims to develop an array of pressure sensors, fabricated in Phase I. The output of this sensor array will be received on a display, PC or Android device, as a 3D pressure map. This array will be used to map the pressure contours of foot plantar of diabetic patients.

Ergonomics intervention in traditional brick making industry on removal of drudgery and developing safe work conditions towards enhancement of productivity

PI: Prof. G. G. Ray
Co-PI: Prof. N Sadhu
IDC School of Design

Brick manufacturing in India is a traditional and unorganised industry. Considering the system complexity, workers' literacy level, work related drudgery and awareness of both workers and management on occupational health and safety, the present proposal is aimed at making the work more human.

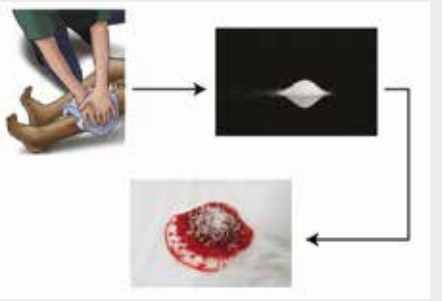
Developing CAR-T cell technology platform for cancer immunotherapy



PI: Prof. Rahul Purwar
Dept. of Biosciences & Bioengineering

B cell-Acute Lymphocytic Leukemia (B-ALL) is a form of haemotological malignancy or leukemia, which is most common in childhood. Haematological malignancies are malignant neoplasms (cancer) that are treated by haematologists and oncologists. Recently, Chimeric Antigen Receptor (CAR) T-cell therapy has shown remarkable results in treating haematological malignancy especially B-ALL. This project is aimed at developing the CAR-T cell platform; CAR-T cells work very effectively in treating relapse and refractory in B-ALL patients.

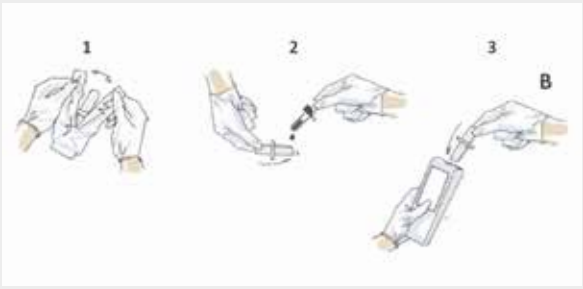
Hemosorb-Haemostatic dressing for trauma care



PI: Prof. Rohit Srivastava
Dept. of Biosciences and Bioengineering

The proposed solution is to develop a haemostatic device which will achieve rapid effective control of bleeding in a wide range of conditions and try to minimize the time frame. The product prototype that has been developed is being tested to be easy to be administered even by a non-professional personnel, is sustainable for several hours if emergency medical aid is delayed and of low cost with a good biocompatibility. A portable pocket size device containing non-toxic muco-adhesive material for control of hemorrhage, would be the final prototype out of this project.

Development of a point-of-care test for the detection of pathogens causing urinary tract infections



PI: Prof. Rinti Banerjee
Dept. of Biosciences and Bioengineering

Treatment of UTIs by non-evidence based prescription of antibiotics by the physicians has resulted in increased drug resistance and rise in costs of treatment. This project aims to develop a point-of-care device that will result in quick detection of urinary pathogens for patients with urinary tract infections in rural and semi-urban areas, thereby doing away with the burden to travel to a pathology centre and wait for test results. The project would pave the way for a rational drug therapy to the patients, solving the problems related to large scale development of drug resistance in the developing countries.

Home based nutrition counseling program

PI: Prof. Mrinmoyi Kulkarni
Dept. of Humanities & Social Sciences

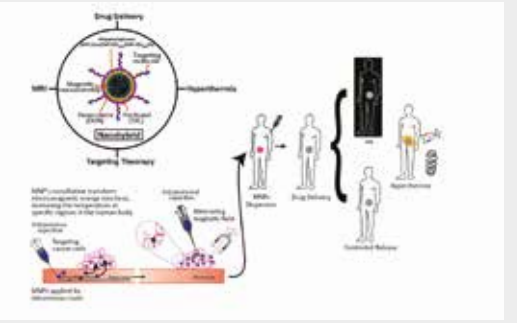
Malnourishment is linked to half of all child deaths and is also responsible for 35% of the disease burden of children below 5, worldwide. Various studies have indicated a relationship between stunting and impaired cognitive development. In addition, women being underweight in the reproductive age group are very likely to give birth to babies with low birth weight, which is a potent risk factor for the child's physical and mental development. As a part of this project, a home-based nutritional counselling program will be developed that will incorporate behaviour change techniques in terms of the feeding behaviour of the mother.

Cervical cancer screening

PI: Prof. Santosh Noronha
Dept. of Chemical Engineering

One of the chief problems of addressing cervical cancer is the absence of a community-level screening system. This project aims to design an inspection device that will capture a printable/electronically transferrable high-resolution image of the cervix. The device would be able to print or electronically send the cervix images to a higher level facility, in order to avoid the need for repeating the test. In addition, video tutorials around the final product would be developed to facilitate training cyto technicians to interpret pap-smear slides accurately. It would also be used by village level health workers to screen, and advise women at the community level.

Functional nanohybrids for cancer treatment



PI: Prof. Dhirendra Bahadur
Dept. of Metallurgical Engineering & Materials Science

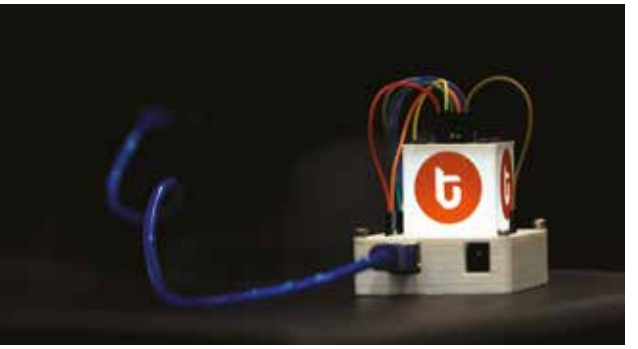
As a proof of principle, the project intends to use sub-cutaneous tumour xenograft model of ovarian carcinoma (stably expressing luciferase, a bioluminescent reporter) to monitor the localisation and efficacy of these nano-materials in immune deficient nude/SCID mice. In this study, the use of optical imaging will help to evaluate the developed nano-particles in luciferase tagged tumour xenografts model. The project aims to see the combinatorial effect of the drug loaded nano-particles in combination with hyperthermia over the tumour model in vivo.

Non-invasive delivery of non-steroidal drugs

PI: Prof. Rohit Srivastava
Dept. of Biosciences & Bioengineering

The project proposes to develop an affordable non-invasive drug delivery system to administer pain relieving drugs for a prolonged period of time without any requirement for human intervention in patients suffering from rheumatoid arthritis or osteoarthritis. Based on principles of sonophoresis, the system will use acoustic waves in the ultrasonic frequency range to create a reversible effect of increasing the size of pores in skin, to create a passage for the drug molecules.

Point-of-care devices for detection of biochemical markers



PI: Prof. Santosh Noronha
Dept. of Chemical Engineering

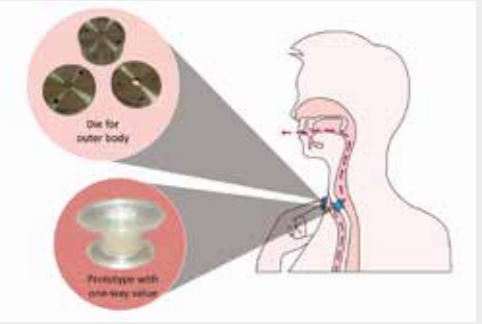
This project aims to develop an inexpensive point-of-care (POC) multiplexed immunodiagnostic device for bone turnover markers (BTMs), for the diagnosis of osteoporosis. The plan is to fabricate paper and PDMS-based microfluidic `lab-on-a-chip' POC devices which facilitate simultaneous detection of multiple BTMs in a blood sample. A smartphone-based spectrophotometric reader will also be built, to permit convenient on-site quantification of test results.

Low-cost point-of-care platform for blood analysis

PI: Prof. Debjani Paul
Dept. of Biosciences & Bioengineering

This project aims to develop an impedance-based platform to detect different blood cells. It also proposes to develop a plastic micro-fluidic cartridge to work with the proposed detection system such that test can be done with very small volumes of blood, unlike the systems currently in use. The long-term goal is to use the detection platform to identify fetal cells in maternal blood for fetal genetic testing, to replace risky and invasive diagnostic processes like amniocentesis.

Product for voice prosthesis



PI: Prof. Prasanna Gandhi
Dept. of Mechanical Engineering

The project aims to eliminate the problems of the available voice prosthetic devices by improving on the design of the existing devices, to achieve a low cost, long-life indigenous prosthetic device that can be commercially produced. The basic idea is to make this device easy for removal and cleaning on a daily basis, just like in case of contact lenses and dentures. The proposed design has been tested for functioning, and has progressed to clinical trials.

Housing

Sustainable housing solutions for flood-prone areas: Case study- Kuttanad region, Kerala

PI: Prof. N C Narayanan
Centre for Technology Alternatives for Rural Areas
Co-PI: Vitasta Raina, External Consultant

Kuttanad taluka in central Kerala, India, which covers three districts in a low-lying largely agrarian region, witnessed one of the worst instances of flooding in 2018. The key challenges for this taluka include affordability, geography and soil condition, environmental sustainability and design challenges. The project will look at addressing these challenges in the building industry in the region and promote the use of innovative, local materials, passive cooling techniques and issues of housing affordability, within a framework of developing a model for flood-resistant housing for Kuttanad.

Early warning solutions for low cost economies

PI: Prof. Santosh Noronha
Dept. of Chemical Engineering

The evolution of disaster management systems for dissemination of early warnings to local communities has not kept pace with the development of forecast technologies. Oxfam India has approached the Centre, in coordination with TISS, Mumbai, to look into the creation of low cost early warning solutions that are robust and widely deployable in high risk areas. Two early warning system variants have been identified – lifeboxes and lifetowers – to be integrated into pre-existing systems. The current proposal intends to assemble the two variants and evaluate them for their efficacy.

Improved kitchen air quality in Mumbai's Dharavi slum

PI: Prof. Ronita Bardhan
Centre for Urban Science & Engineering
Co-PIs:
Prof. Leslie Noford, MIT, USA
Prof. Rishee Jain, Stanford University, USA

This project proposes a measurement, simulation, and engagement campaign that focuses on one element of sustainable design: indoor concentrations of suspended particulates associated with cooking which is one of the primary causes of HAP. The research opportunity for this project is to develop and support an evidence-based design process that could, among other elements, include design guidelines and simulation workflows appropriate for climate, culture, technology and economics and suitable for use by practicing architects and engineers, that will improve the lives of Dharavi residents while remaining within business models acceptable to developers.

Innovative financial models for affordable housing segment

PI: Prof. Shishir K Jha
Co-PI: Prof. Arti Kalro
Shailesh J. Mehta School of Management

The financial infrastructure for low-income groups is weak or almost absent in most parts of India. The use of process and product oriented innovations by the BOP consumers remains a challenge as they experience a gap, between their desire to embrace new innovations and their inability to purchase given their financial conditions. This project proposes and discusses a framework that can be used by various organisations to provide the intended beneficiaries with access to a low cost, stable and an enduring micro-financial structure, particularly in the housing and energy sector.

Development of noise damping coatings

PI: Prof. A. S. Khanna
Dept. of Metallurgical Engineering & Materials Science
Co-PI: Asst. Prof. Sivasambu Bohm
External Consultant

Application of sound damping coatings to steel roofs will reduce noise and also help improve their durability and effectiveness. Providing such roofs to people is a step towards innovation and a help in making lives of people living under these roofs better. This study aims to improve the sound damping properties of the galvanized steel used for structural applications. Since a lot of houses in India are made up of steel in roofing applications, the outcome of this work will directly impact those living under such roofs.

Fitting more in volume

PI: Prof. Vijay Bapat
Co-PI: Prof. U. Athavankar
IDC School of Design

There is a huge demand of housing in Mumbai and the rising land costs ensure unavailability of land for housing for poor. In this scenario, the building footprint counts a lot. The project deals with providing alternate solutions to the housing design by utilising volume provided. The aim of the project is to accommodate a family of 4+2 in a volume of 10'X10'X12.5'. The first stage of this project is done and the prototype has been demonstrated in June 2015. Current works on this project includes designing and detailing furniture which will create spaces in the volumetric housing interiors.

Mass produced components for affordable housing

PI: Prof. B. K. Chakravarthy
Co-PI: Prof. Kumaresan
IDC School of Design

This project aims to:
1. To study current and typical construction practices and techniques used, and establish how and where mass-manufacturing can contribute to affordable housing.
2. To survey existing pre-fab technology in India or elsewhere.
3. To develop ideas for limiting construction costs through meaningful and selective use of mass-manufacturing techniques.
4. To develop ideas for products and product systems that complement the frugal lifestyle of the target population while meeting their aspirations.

Water

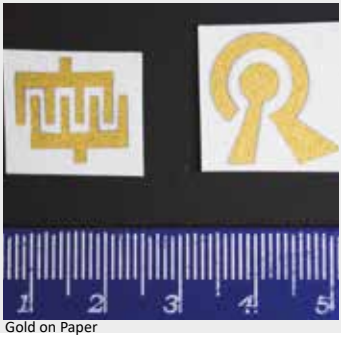
Evolving and articulating technology-based innovations for enhancing access to water and sanitation of BoBoP (Bottom of the Base of Pyramid) sections of society in Mumbai city

PI: Prof. Subodh Wagle
Centre for Technology Alternatives for Rural Areas
Co-PIs: Prof. Pradip Kalbar
Centre for Urban Science & Engineering
Prof. Pramod Khambete
IDC School of Design

The proposed solution will include schematic designs of facilities for providing water and sanitation services and those involved in on-site wastewater treatment, fecal sludge management, and medical waste management. The focus will be to evolve a set of solutions that will make an integrated combination of technological element, community management, local entrepreneurship, and participatory governance.

EIS platform for bacteriological monitoring of water

ImScope + Paperelectrodes

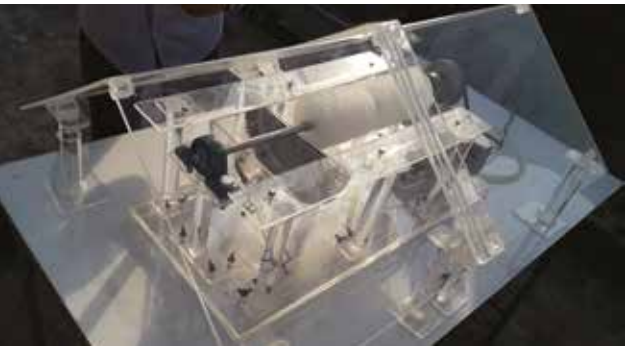


Gold on Paper

PI: Prof. Soumyo Mukherji
Dept. of Biosciences & Bioengineering

This project aims at the quality control of recycled grey water using electrochemical impedance spectroscopy. There is a need for a sensor that can determine the quality of the grey water after the treatment process as well as the efficiency of the treatment plant, by using sensors both at the inlet and the outlet of the plant. The proposed sensor intends to detect any bacteria present in water and is non-specific in nature. The next plan is to develop a portable device as an alternative to the available bench top setup of frequency response analyzer for impedance spectroscopy measurements, which can be used directly in the field.

Characterization of grey water and development of a cost effective system for grey water recycling



PI: Prof. Suparna Mukherji
Co-PIs: Prof. Sanjeev Chaudhari
Prof. Anurag Garg
Environmental Science & Engineering Dept.

There is much incentive for exploring grey water recycling options for non-potable uses and its recycling can help tide over the water scarcity problems. It is essential to characterize grey water and formulate cost effective treatment strategies for promoting grey water reuse. Once the status and potential are identified through the findings of this project, the results of this study may be shared with the residents of IIT Bombay Campus, and benefit other residential university campuses and housing societies.

Heavy metal sensing in water using optical fiber sensors

PI: Prof. Soumyo Mukherji
Dept. of Biosciences & Bioengineering

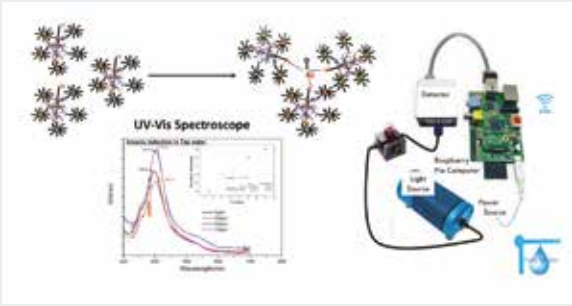
It is very essential to develop a low-cost, portable, user-friendly biosensor which can detect the toxic heavy metal ions in water, with very low limit of detection (LOD). The current study will develop a highly sensitive optical sensor which will be able to detect even a trace amount of heavy metal, if present, in water. The development and improvement of optical sensors are driven by continuous demand for simple, rapid, sensitive and in-situ monitoring techniques. This study will be a significant step towards the utilization of the optical properties of polyaniline, to develop a highly sensitive heavy metal sensor.

Comparison of various available domestic water purifiers and building the basic understanding and knowledge data base

PI: Prof. Sanjay Mahajani
Dept. of Chemical Engineering
Co-PI: Dr. Murali Sastry
CEO, IITB - Monash Research Academy

This project aims to establish a water lab at Tata Centre, where the existing water purifiers are tested for performance and reliability. At the end of the study, the quantitative and qualitative performance data for these purifiers can be used as a guideline for selection and deciding the rating of the products. This study will give insight into the existing water filtration products market and create a database to be used for baseline studies, in the future.

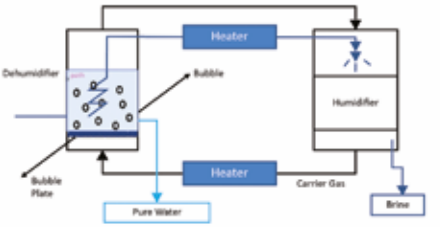
Detection and sensing of arsenic in drinking water



PI: Prof. Rajdip Bandyopadhyaya
Dept. of Chemical Engineering

Arsenic is a major problem leading to health hazards in major areas of India and other nations. The proposed project will investigate the method of arsenic detection and measurement. Various sensing techniques are reported, however all suffer from the specificity problem when analyzing real samples. There is a large interference due to other ions. The need of the hour is to develop a highly specific sensing platform that can do the sensing of arsenic automatically. Based on the success of this project, other organizations will be partnered with and the methods will be implemented for specific target groups.

Humidification-dehumidification desalination system



Schematic of the proposed desalination design

PI: Prof. Shankar Krishnan
Dept. of Mechanical Engineering

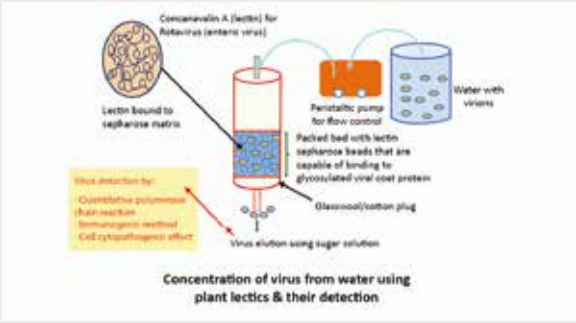
The goal of the proposal is to demonstrate a humidification-dehumidification (HDH) system using low-cost, compact and high performance humidifier and dehumidifier components and improved heat recovery. The proposed HDH system in this study is ideal for small-scale desalination applications. This includes no parts which require extensive capital cost and maintenance. Among the many available technologies, humidification-dehumidification (HDH) desalination technology appears to be an extremely promising and decentralized drinking water technology. HDH technology mimics the natural rain cycle.

Extraction of water from air for rural household drinking water requirements

PI: Prof. Anil Kottantharayil
Dept. of Electrical Engineering

This project proposes a simple technique that would be able to provide safe drinking water in an efficient and cost-effective manner. The idea is to use a deliquescent salt that would absorb moisture from the ambient, preferably from late evening to early morning. During daytime, the collected deliquescent solution is put in a specially designed compartment similar to a solar still to induce greenhouse effect. Water from the deliquescent salt solution is made to evaporate due to the trapped heat from the sunlight which then condenses on the transparent (glass) surfaces.

Development of a cheaper and reliable method for concentration and detection of enteric viruses in potable water



Concentration of virus from water using plant lectics & their detection

PI: Prof. Sumathi Suresh
Environmental Science & Engineering Dept.

Our project is focused on the use of array of immobilized plant lectins for the capture of water-borne enteric viruses (such as rotavirus) from large volumes of water. Captured virions will be eluted from the lectin sepharose matrices using corresponding sugar solutions and subsequently detected using cell culture assays, immunogenic methods or quantitative polymerase chain reactions (Q-PCR). The process should benefit for monitoring biological quality of water bodies processes in the manufacture of water purification filters.

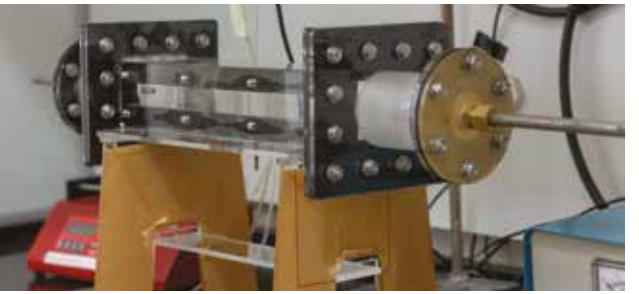
Development of clay-based water purifier considering local needs, skills and materials

PI: Prof. A. B. Rao
Centre for Technology Alternatives for Rural Areas
Co-PI: Prof. Shireesh B. Kedare
Dept. of Energy Science & Engineering

Access to safe drinking water is a major problem - in rural areas as well as areas affected by natural calamities like floods. Even if water is available in these areas, the quality of water is questionable in these circumstances. This project proposes a design of water purification system that is portable as well as independent of electric power supply.

Waste Management

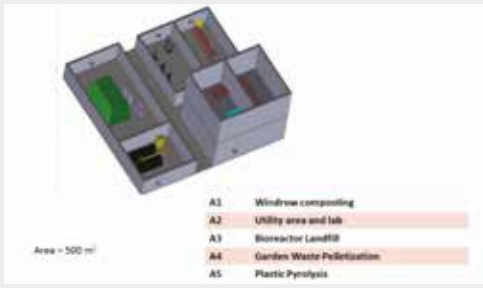
Electrospray based indoor air cleaner development



PI: Prof. Rochish M Thaokar
Co-PIs: Prof. Y S Mayya
Prof. Chandra Venkataraman
Dept. of Chemical Engineering

Indoor air pollution and its effects on respiratory health effects is acute in developing countries where significant particulate pollution is generated by intense and prolonged cooking cycles. The project aims at combining electrospray based particle charging ideas with the existing air filtration methods to enhance the effectiveness of removal at affordable operating costs of the system. The objective is to develop a mitigation technology to reduce indoor air pollution, thereby contributing to the improvement of public health.

Integrated Waste Management facility at IIT Bombay campus



PIs: Prof. Sanjay Mahajani
Dept. of Chemical Engineering
Prof. Anurag Garg
Environmental Science & Engineering Dept.
Prof. Milind V Rane
Dept. of Mechanical Engineering
Prof. Gajananrao Jadhav
Prof. Srinivas Seethamraju
Dept. of Energy Science & Engineering

Municipal Solid Waste (MSW) commonly known as trash or garbage, has the toxic and infectious solid wastes generated, if not treated effectively. The uncontrolled and improper dumping of such wastes have adversely affected human health and environment. Realising the need for bringing in efficient and scientific ways of managing the waste, a group of faculty associated with Tata Centre and

the students have been actively working on a number of projects, addressing various challenges in MSW considering IITB campus as the test bed. The set up for different processes depending on the type of waste would be commissioned at the integrated facility where the entire waste from the campus would be transported. The advantage of such a facility is to provide flexibility in handling the waste that may vary in characteristics and also to generate energy from waste. The facility will enable energy generation in the form of biogas from biomethanation unit, producer gas from pellet gasification, fuel oil from plastic pyrolysis, and good quality compost for gardens. The bioreactor landfill will be used to address non-recyclable waste or to treat the waste in case of an unexpected circumstances such as breakdown of one of the equipment. Once demonstrated as a successful model this can be replicated in other similar campuses, upcoming smart cities, tier I and tier II cities in India.

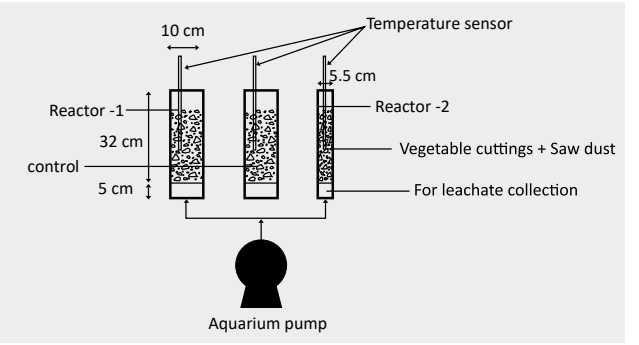
The facility is expected to house the following technological solutions, supported by the Centre.

Conversion of plastic into fuel oil through pyrolysis

PI: Prof. Seethamraju Srinivas
Dept. of Energy Science & Engineering
Co-PI: Dr. Yogendra Sastry
Dept. of Chemical Engineering

There are some items which don't have a recycle value and safe disposal of these is a necessity, especially because municipal solid waste (MSW) has approximately upto 20 percent of mixed plastic waste. The idea of this project is to convert such mixed plastic, predominantly polyethylene (PE), polypropylene (PP) and polystyrene (PS) waste, into fuel oil through pyrolysis. It offers the advantages of converting a waste stream into a source of energy, reducing the amount of waste going to land-fills, and creating value for a stream that is otherwise considered as a waste. The project aims to use available catalysts in the market for the pyrolysis process and make this technology more accessible to everyone.

Development of household or community composting system for food waste recycling



PI: Prof. Anurag Garg
Environmental Science & Engineering Dept.

Management of municipal solid waste (MSW) is a major challenge in most of the developing nations, due to limited funds and poor management practices. This study aims to develop a household/community composting system for the management of segregated food waste generated in homes. The main objective is to design a user-friendly composting bin for achieving efficient and odour-free decomposition of the food waste. Moreover, the effect of microbial inoculum addition would also be studied on the waste decomposition rate.

Gasifier based cook-stoves to manage garden waste

PI: Prof. Sanjay Mahajani
Dept. of Chemical Engineering

Through this project, it is proposed to use garden waste and agro-wastes for better applications. For the ease of transportation and handling, the waste can be converted into pellets or briquettes which can be used as fuel in small scale process industries, and also in gasification based cook-stoves, to partially replace LPG. The work would complement the country's waste management initiatives. A new operation-friendly, emission free and feedstock specific design is envisaged. In this stage of project, a major focus would be on minimizing clinker, tar and particulates, and designing burner for producer gas. A collaboration with Tata Centre at MIT is planned with their facility and expertise in burner design.

Assessment of municipal solid waste based biogas plants in India

PI: Prof. Munish Chandel
Environmental Science and Engineering Dept.

The objective is to assess the MSW based biogas plants and understand its design, operational characteristics and challenges faced during its operation. The assessment includes filling out a detailed survey form/ questionnaire, sample collection for laboratory analysis and in-depth interviews with the operators, technology providers and end users. It is observed that problems faced by the plants are somewhat similar and can be broadly classified into socio-economic and operational challenges. The idea is also to compare the working of different plants and come to some conclusion about best suited design for particular requirement. Also a study is being done on a lab scale single phase anaerobic reactor to recycle the effluent back into the reactor to minimise the fresh water requirement.

Process design for the reclamation of waste sand from small foundries

PI: Prof. Gajananrao N Jadhav
Dept. of Earth Sciences
Co-PIs: Prof. Sanjay Mahajani
Dept. of Chemical Engineering
Prof. Dasaka Murty
Dept. of Civil Engineering

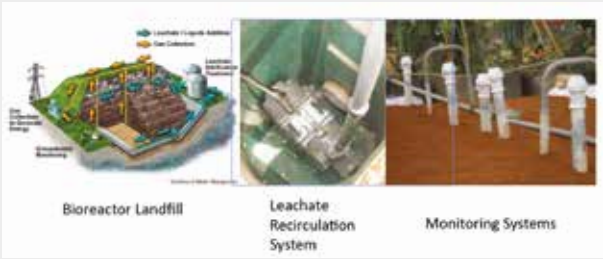
For sustainable development of India, the reclamation of foundry sand is crucial since the rapid rate of growth of foundry production uses huge amounts of foundry sand. In this project, two prototypes have been designed to use reclaimed sand within foundries economically and efficiently - vertical and horizontal fluidized beds, based on the principles of mechanical attrition and impact, to remove dead binder from waste sand. The biggest challenge is to optimize the operating conditions and bring down the reclamation cost to less than that of fresh sand.

Utilization of waste tire rubber and waste plastic for construction of roads

PI: Prof. Dharamveer Singh
Dept. of Civil Engineering

India produces million tons of various types of industrial waste materials annually, yet not many studies have been conducted to utilize the potential of industrial wastes. The present study evaluates the potential of waste tires and waste plastic materials for highway construction, which can provide a sustainable and eco-friendly technique. The study envisages how to generate quality database and guidelines on the effective use of these materials. It is expected that the utilization of industrial waste for construction of pavements will be an environmentally friendly step forward.

Engineered bioreactor landfill for IIT Bombay



PI: Prof. D. N. Singh
Dept. of Civil Engineering

Unlike existing conventional methods of landfilling which involve acquisition of a huge area of land, transportation of the solid waste from source to the landfill and the slow rate of decomposition of waste, an in-house bioreactor landfill ensures a solution. Remains from the landfill are being studied to be used as compost, filler material and soil stabilizers. A study is also being carried out to check the feasibility of extraction of essential oils from the non-biodegradable materials from the remains and the potentiality of the landfill gases generated to meet the power required for the functioning of the bioreactor landfill.

Municipal solid waste characterization and monitoring of existing solid waste management systems in IIT Bombay campus

PI: Prof. Anil Dixit
Environmental Science & Engineering Dept.

This project involves the development of a GIS based Information system for Campus Waste Management, giving information about collection of waste from all residential, academic and hostel sources, their transportation to various processing units like composting and biomethanation for wet waste and manual sorting for dry waste. The inventory of solid waste management and characterisation in the IIT Bombay campus has been collected through actual waste audit.

Multidomain

Facilitating diffusion and adoption of TCTD's innovation projects: Applying diffusion and design theories

PI: Prof. Subodh Wagle
Centre for Technology Alternatives for Rural Areas
Co-PIs: Prof. Shireesh Kedare
Dept. of Energy Science and Engineering
Prof. Pramod Khambete
IDC School of Design

The core idea of the proposed project is to improve efficacy, pace, and sustainabilty of the diffusion and adoption of innovations and, thus, enhance, their social impact of various products and services innovated for the BoP sections of society. To this end, the project will try to apply the concepts, theories, models, practices, methods, and practical insights emerging from the literature and practice built around the diffusion of innovation theory as well as Design Thinking, and User Centered Design and Service Design theories.

Enhancing development impact by facilitation of participatory exercises at TCTD

PI: Prof. Shireesh Kedare
Dept. of Energy Science and Engineering
Co-PIs: Prof. U V Bhandarkar
Dept. of Mechanical Engineering
Dr. Vijay Honkalaskar, External consultant

Employing participatory practices in the present activities/projects at TCTD will increase the understanding of specific problems of people. In this respect, the present project may be taken up as an ongoing activity for different projects under TCTD and may be extended further based on the experience of the first year. The project will also identify new and relevant problems leading to more projects for technology development and dissemination.

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