Medical
Instruments & Devices

Azadi Ka Amrit Mahotsav

CSIR-INDIA

सीएसआईआर – केन्द्रीय वैज्ञानिक उपकरण संगठन
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CSIR-Central Scientific Instruments Organisation
Sector 30-C, Chandigarh-160 030 (India)

From Director's Pen

It gives me immense pleasure to present this Compendium of Technologies for biomedical applications being developed at CSIR-CSIO. This compendium presents the products of the efforts of our scientific teams to provide technological solutions covering a wide spectrum of healthcare technologies. As we comprehend, medical instruments have become an essential part of today's healthcare system not only for screening and diagnostics, but also to monitor for better management of diseases and helping patients to lead a normal life. Advantages of high quality medical devices includes, precise diagnosis for effective treatment; reduced treatment cost; reduced hospital stay; accessibility to quality healthcare etc.

CSIR is an important player in the National Innovation System providing technologies/ products/ processes for the scientific and industrial growth of the country. CSIR-CSIO, one of the constituent lab of CSIR, is also working for the development of Indigenous medical devices ranging from electronic devices, biosensors to bio-implants. These biomedical activities is well aligned with the Government of India initiatives for the focused S&T efforts towards the development of medical instrument & devices for reducing the import burden.

As any technology development and its successful induction would not be possible without a close association and interaction among the various stakeholders, this compendium has been made as an endeavour to reach out to our current and the prospective collaborators for their engagement in taking the development to the stage of market-ready product for commercialisation.

I am sure that the readers would find this edition of the compendium informative and would get back to us for their engagement and valuable suggestions in achieving product excellence.

Come, let's work together for a better future!

Jai Hind…!

(Prof. S Anantha Ramakrishna)
Director, CSIR-CSIO, Chandigarh

About CSIR

Council of Scientific & Industrial Research (CSIR), India was constituted in 1942 as an autonomous body under the provision of the Registration of Societies Act XXI of 1860. The Council, through its constituent laboratories, has helped the country in increasing the economic growth and industrialization. CSIR envisages a vision of CSIR@2030 as to *"Enhance quality of life of the citizens of India through innovative Science and Technology, globally competitive R&D, by developing sustainable solutions and capacity building to fulfil dream of Atmanirbhar Bharat".* This vision of CSIR is aligned to the Government of India's vision for the next 25 years 'Amrit Kal' when independent India becomes 100 years old.

Its chain of 37 world class R&D establishments with 39 outreach centers, 1 Innovation Complexes, and 3 units spread across India are manned by highly qualified scientists and engineers, besides auxiliary and other staff. CSIR covers a wide spectrum of science and technology – from radio and space physics, oceanography, geophysics, chemicals, drugs, genomics, biotechnology and nanotechnology to mining, aeronautics, instrumentation, environmental engineering and information technology. It provides significant technological intervention in many areas which include environment, health, drinking water, food, housing, energy, farm and non-farm sectors.

Pioneer of India's intellectual property movement, CSIR today is strengthening its patent portfolio to carve out global niches for the country in select technology domains. CSIR is granted 90% of US patents granted to any Indian publicly funded R&D organization. On an average CSIR files about 200 Indian patents and 250 foreign patents per year.

CSIR has operationalized desired mechanisms to boost entrepreneurship, which could lead to enhanced creation and commercialization of radical and disruptive innovations, underpinning the development of new economic sectors.

For more details, visit www.csir.res.in

About CSIR-CSIO

Central Scientific Instruments Organisation (CSIO), a constituent unit of Council of Scientific & Industrial Research (CSIR), is a premier national laboratory dedicated to research, design and development of scientific and industrial instruments. It is a multi-disciplinary and multi-dimensional apex industrial research & development organisation in the country to stimulate growth of Instrument Industry in India covering wide range and applications.

CSIR-CSIO is a multi-disciplinary organisation having state-of-art laboratories manned by highly qualified scientists engaged in R&D of scientific instruments for diverse application areas such as Biomedical Applications; Imaging, Avionics & Display systems; Manufacturing Science & Instrumentation; Material Science & Sensor Applications; Intelligent machines & Communication Systems; Energy management Technologies; Intelligent Sensors & Systems; and Micro & Nano Optics. Large number of instruments ranging from simple to highly sophisticated ones, have been designed & developed and their know-how have been passed on to the industries for commercial exploitation. Having contributed substantially towards the growth of the scientific instruments in the country, CSIO enjoys high degree of credibility among the users of the instruments as well as the instrument industry.

MANDATE

- Research, design & development of scientific & industrial instruments, components and systems
- Testing & calibration of instruments/ components
- HRD in the area of instrumentation
- Technical assistance to industry

MISSION

- To carry out translational research and development in niche areas of innovative instrumentation technology
- To provide high quality human resource development in advanced instrumentation
- To emerge as a global player in the field of instrumentation sciences

For more details, visit www.csio.res.in

About Biomedical Applications Group

Biomedical Applications is one of the important areas of R&D at CSIR-CSIO, Chandigarh. The group is actively engaged in the development of medical technologies with focus areas as Diagnostics & Therapeutic devices, Rehabilitation & Assistive technologies for elderly & differently abled population, Imaging based medical devices and Advanced manufacturing based orthopaedic implants. The problems addressed under the different focus areas are as below:

Diagnostic & Therapeutic Instruments: Point of care non-invasive solutions, state of art patient monitoring and disease management technologies, ICU instruments & surgical assistive solutions etc.

Imaging & Machine Intelligence based Technologies: Advanced imaging solutions for diagnostic and surgical applications, machine vision based technologies to aid healthcare professionals

Rehabilitation & Assistive Technologies: Rehabilitation and assistive devices by using robotics, artificial intelligence & virtual reality technologies, orthotic & prosthetic device, etc.

Advanced Orthopedic Implants: Technologically advance orthopaedic implants at affordable level, pelvis revision surgery implants, interbody fusion spinal cages, scaffolds etc.

This compendium presents the technologies under above focus areas where the scientists of BMA group has been working recently.

For more details of BMAG, scan me or contact

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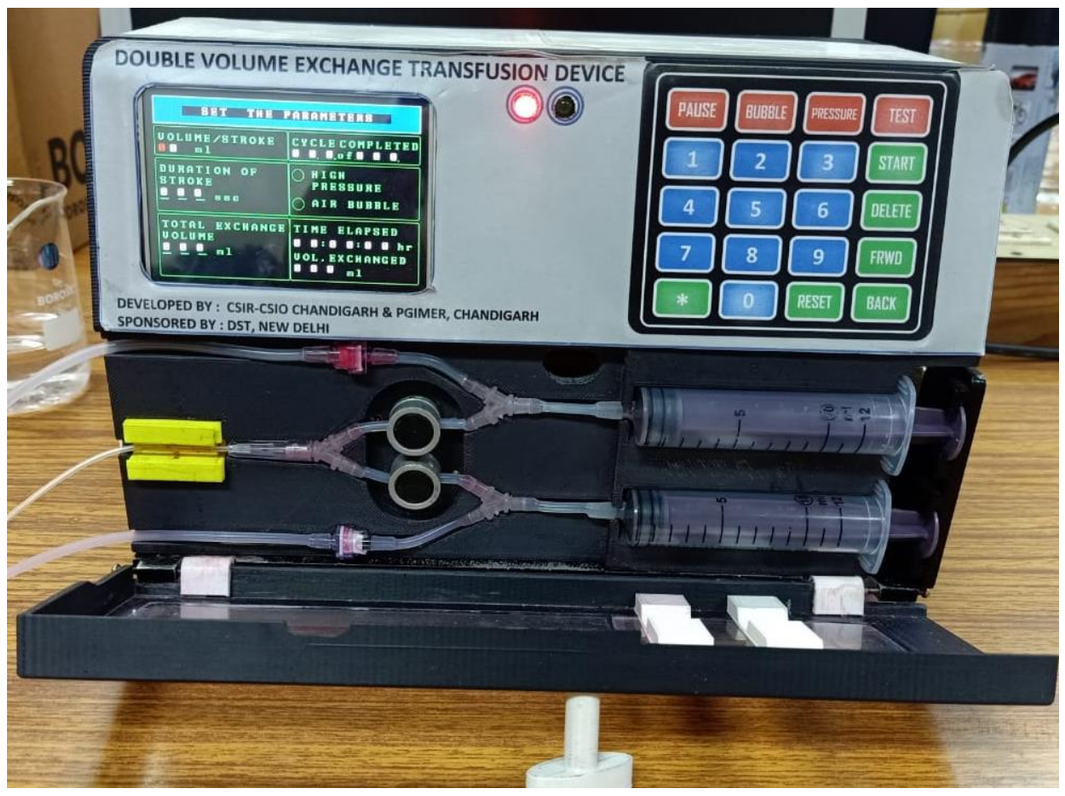
Diagnostic & Therapeutic Instruments

MACHINE FOR PERFORMING DOUBLE VOLUME EXCHANGE TRANSFUSION



Severe jaundice (hyperbilirubinemia) is a common problem amongst newborn infants. Most infants with severe jaundice require phototherapy but a few does not respond to it and require a Double Volume Exchange Transfusion. It involves replacing the entire blood volume of the neonate twice over with adult donor blood.

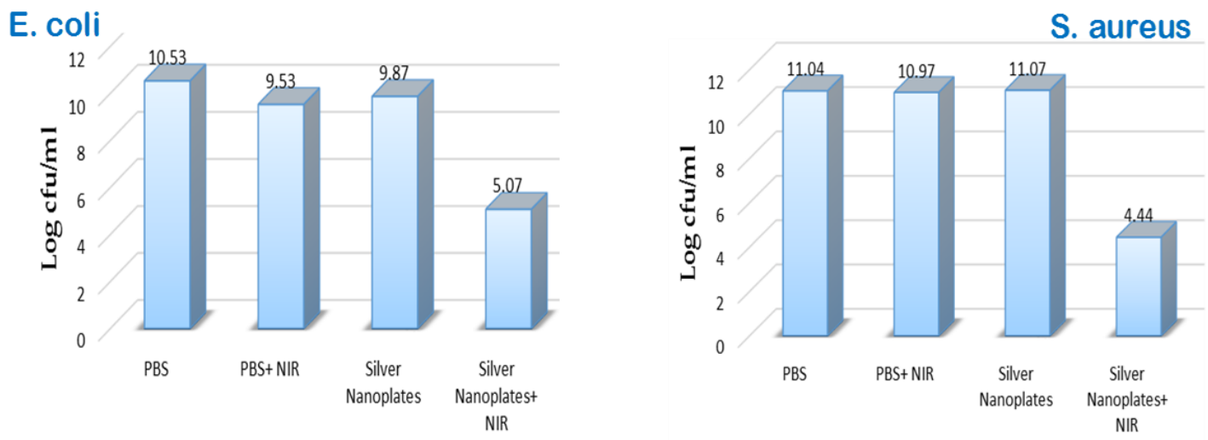
FEATURES:

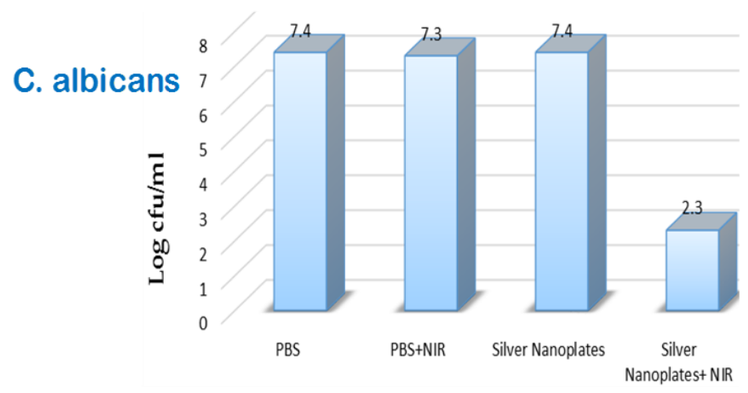
- Automates the manual procedure of transfusion through umbilical vein
- Ensured and calibrated smooth flow of blood into and out of the baby
- Reduced chances of unintended hypervolemia, hypovolemia, hemodynamic fluctuations
- Biocompatible and disposable fluid flow circuit
- Air-bubble and Clot detection
- Reduces wastage of time and fatigue amongst doctor
- Audio – Visual Alarms: *Bubble and Clot detection; Syringe not fixed*
- User set parameters: *Aliquot Volume; Baby Weight; Stroke duration*

Developed by CSIR-CSIO, Chandigarh & PGIMER, Chandigarh. Sponsored by DST, New Delhi

PHOTOTHERMAL BASED STERILIZATION DEVICE

Broad Antimicrobial Efficiency (5-7 Log cfu reductions)





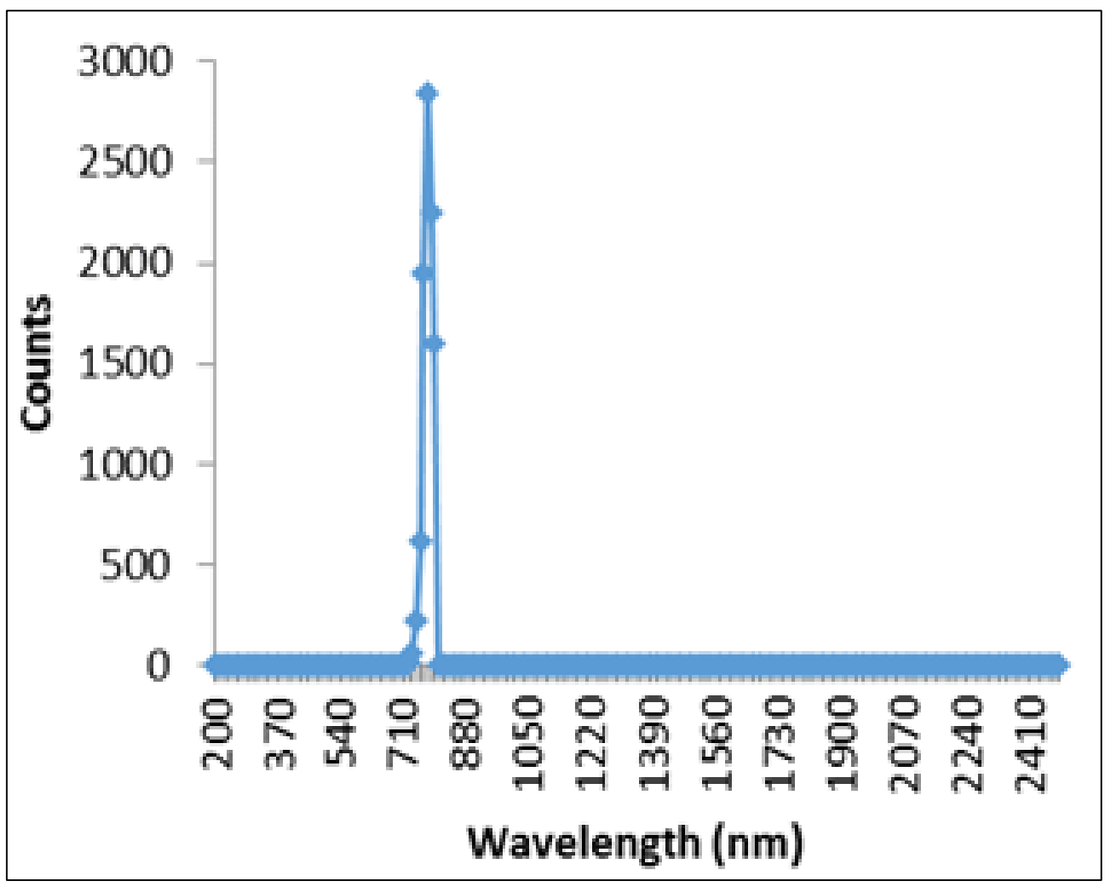
Hospital acquired infections especially due to surgery related issues are a major concern and there is need for better sterilization techniques, which are quick and cost effective in destroying pathogens. Here, light interaction of nanoparticles, is used for sterilization to get rid of hospital borne pathogens like ESKAPE and Candida etc.

FEATURES:

- Short sterilization cycle duration (15-20 minutes total)
- Mild operating parameters (atmospheric pressure, 50-70°C)
- Ability to sterile broad range of pathogens including fungus
- Immediate sterilization, at point of care is possible
- Non-ionizing radiation
- Nanoparticle suspension can be used for multiple cycles
- User set parameters: Cycle time, Temperature etc.
- Monitored Parameters: Time, Temperature, Input power etc.
- Audio – Visual Alarms: ON/OFF, cycle completion etc.
- Affordable and simple setup for rural/limited resource settings

Developed by CSIR-CSIO, Sponsored by CSIR, New Delhi

NEAR-INFRARED LIGHT SOURCE CUM PHOTOTHERMAL DEVICE



The device provides tuneable near-infrared electromagnetic radiation (customized high optical output) of desired centre wavelength and spectral bandwidth through replaceable optical bandpass filters. Such light source can be used for applications like photochemistry, photobiology, microscopy, fluorescence and biomedical etc.

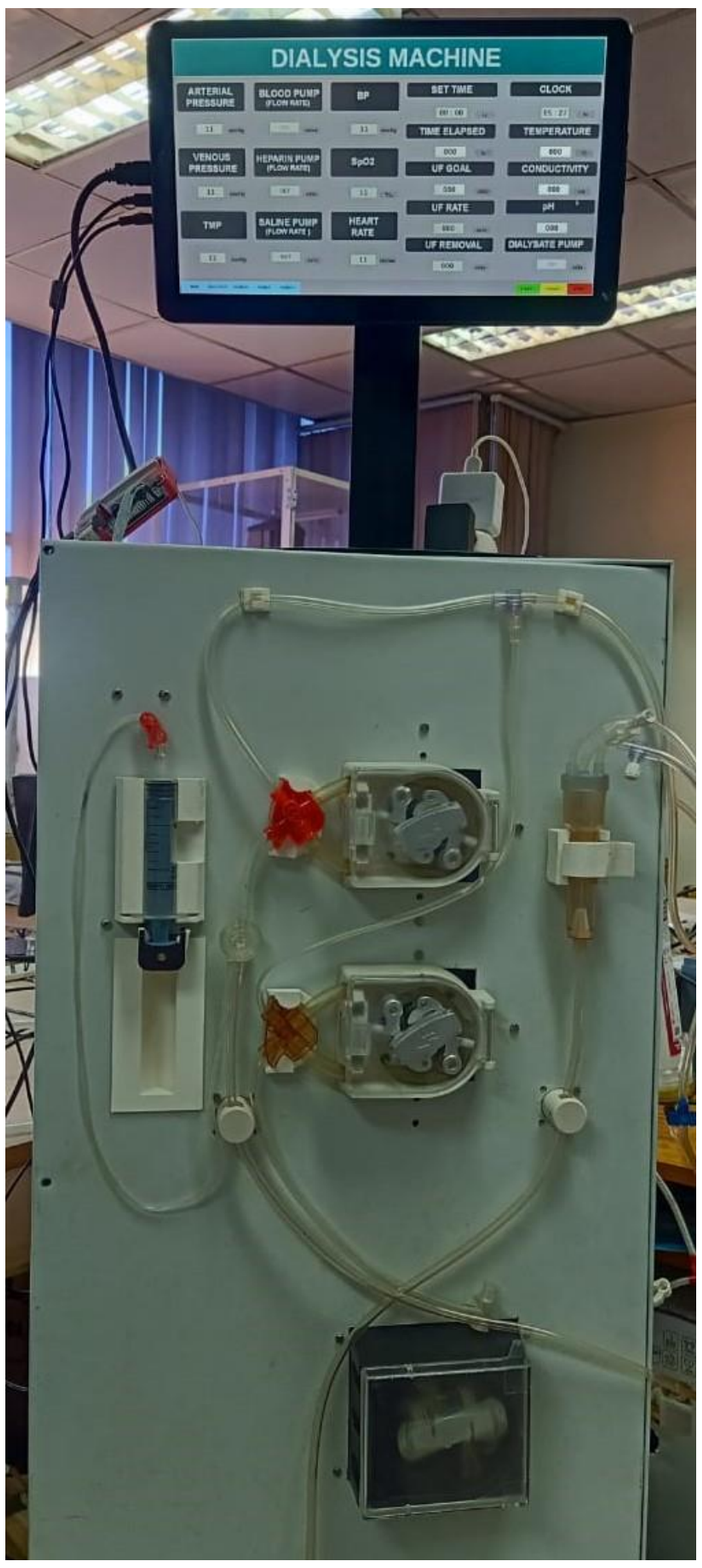
It utilizes a halogen lamp and optical assembly comprising of lenses & specially designed spectral filter elements. There is a provision of integrated thermocouples for measuring the temperature of a sample on irradiation (light interaction) and temperature control through synchronised operation of the light source.

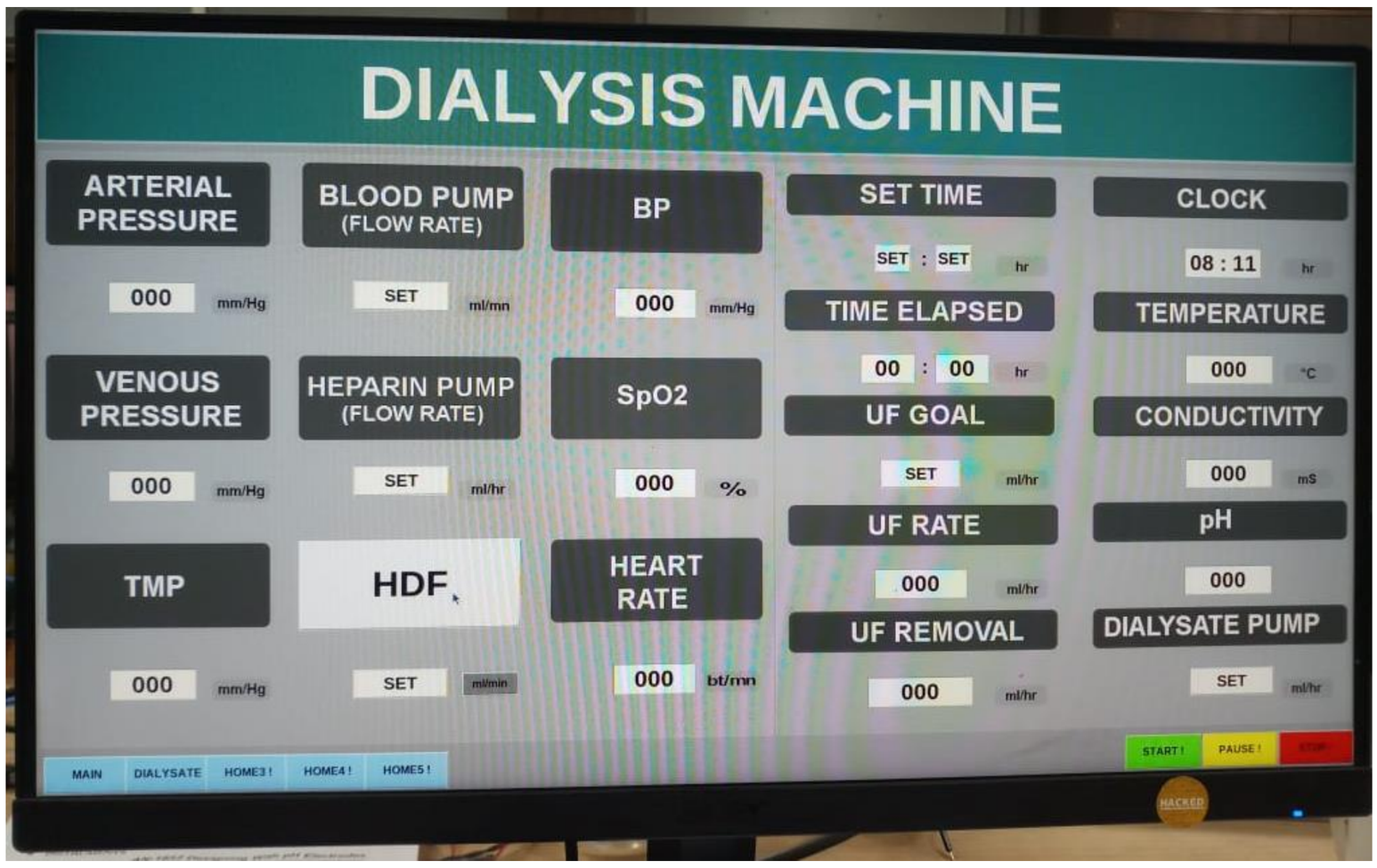
FEATURES:

- Operational modes: Automatic/ Semi-automatic/ Manual lamp ON/OFF
- Integrated thermocouples for synchronized temperature acquisition
- Microcontroller based control feedback to attain the set temperature
- Timer / Temperature threshold function to stop the lamp/irradiation
- User interface through keypad and LCD display
- Temperature data acquisition on a PC through USB interface
- Replaceable optical band pass filters to tune the spectral output
- Special feature: High optical power handling & spectral extraction

Developed by CSIR-CSIO, Chandigarh. Sponsored by DBT, New Delhi

DIALYSIS MACHINE FOR HAEMODIALYSIS OF CKD PATIENTS





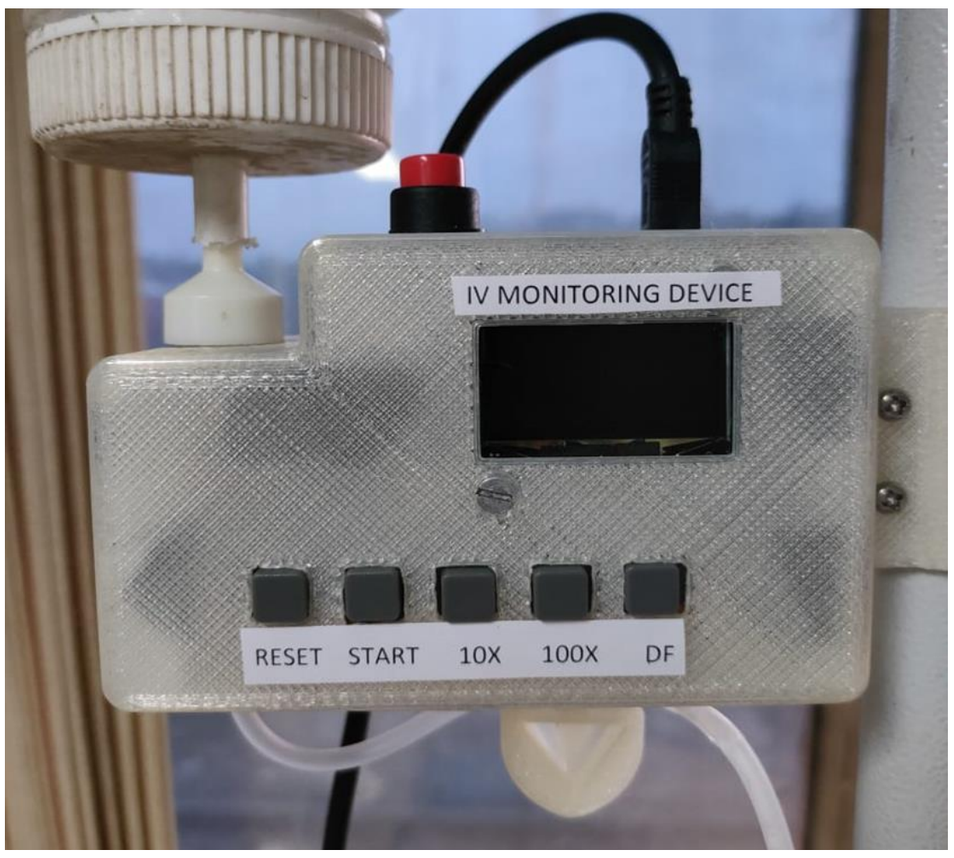
Chronic kidney disease (CKD) is a worldwide health crisis where the kidney slowly loses its functioning and fails. Dialysis machine removes blood from the body, filters it through a dialyzer (artificial kidney) and returns the filtered blood to the body.

FEATURES:

- Indigenous peristaltic blood pump
- Saline/ Hemodiafiltration pump for infusion of saline/ water
- Indigenous Heparin pump for the infusion of heparin
- Dialysate pump for continuous flow of Dialysate liquid
- Detection of Air-bubble, Clot, Blood leakages, Over-pressure alongwith Audio-Visual alarm
- User set parameters: *Blood Pump flow rate; Saline/HDF flow rate; Heparin flow rate; Dialysate flow rate; Time of Dialysis; Ultra filtration Goal*
- Machine calculated parameters: *Ultra filtration rate; Time elapsed*
- Monitoring of Sensor parameters: *Arterial Pressure; Venus Pressure; RTC; Temperature, pH & Conductivity of Dialysate, TMP*
- Monitoring of Body Parameters: BP; SpO2; Heart rate
- Biocompatible and disposable Blood flow circuit

Developed by CSIR-CSIO, Sponsored by CSIR, New Delhi

INTRAVENOUS INFUSION MONITORING DEVICE

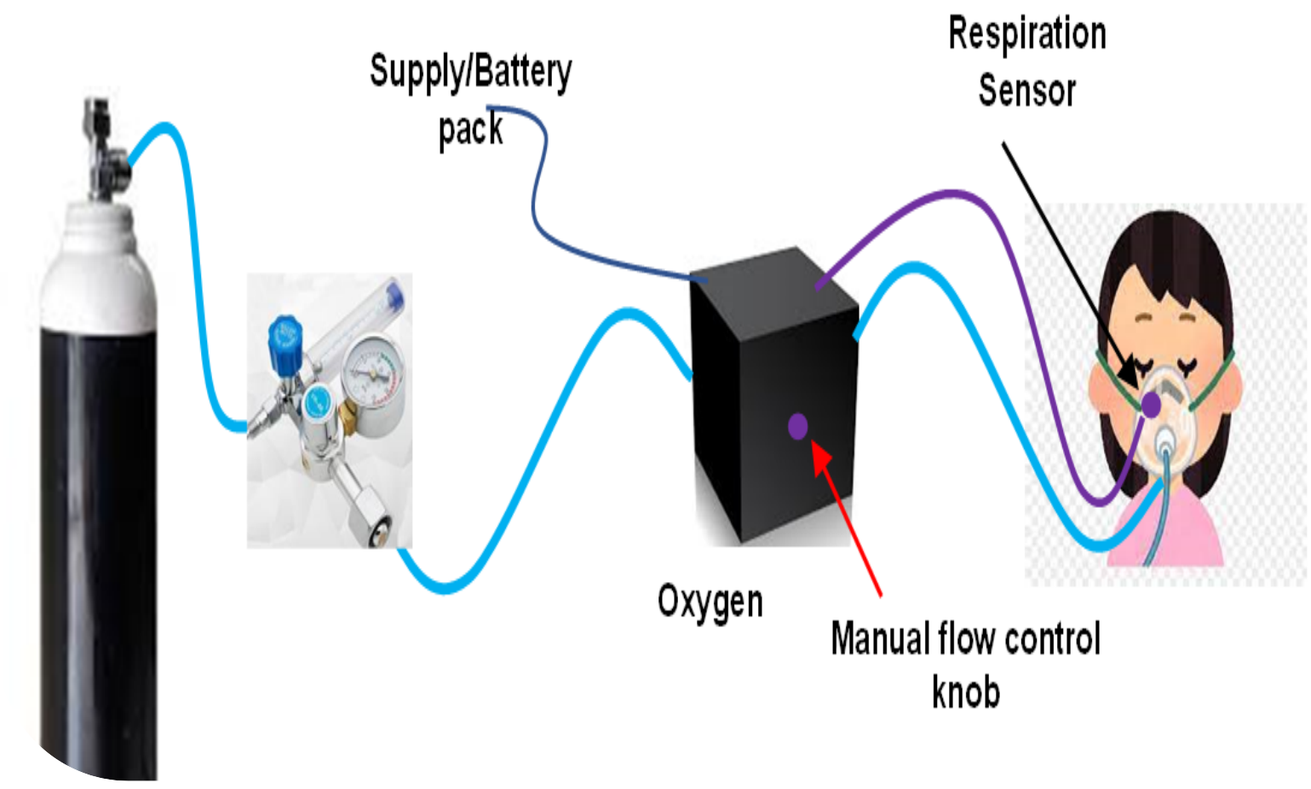


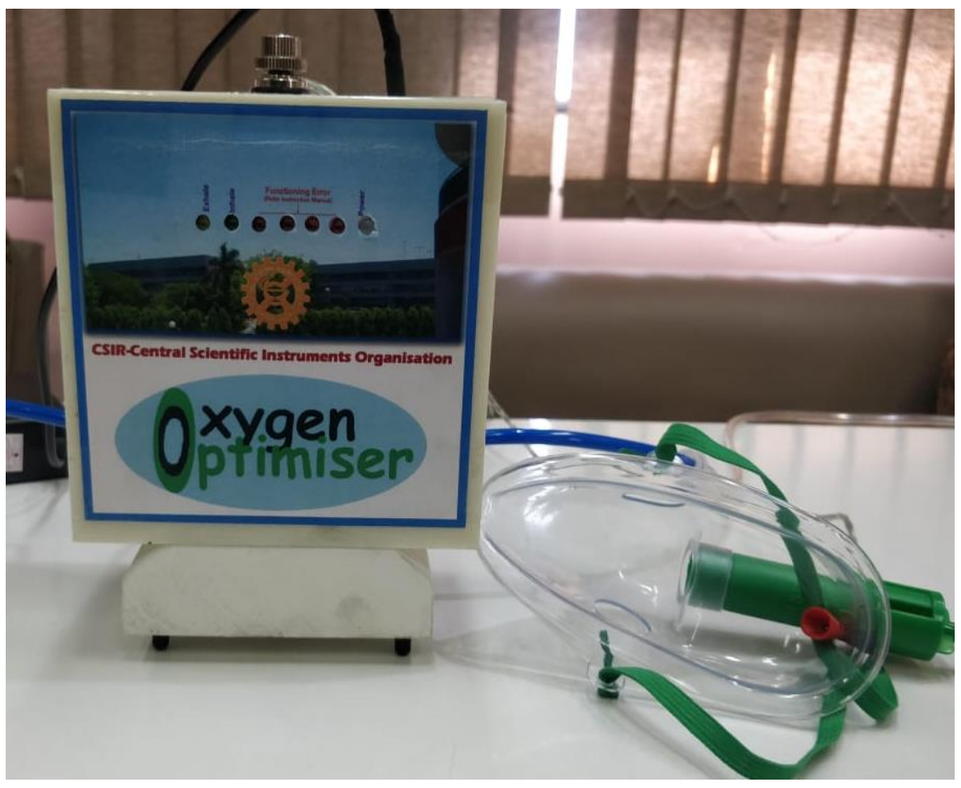
Intravenous infusion monitoring device is meant for active monitoring and quantification of intravenous infusion, a frequently used modality in a hospital ward with every bed or during the disaster, etc. Once the saline bottle becomes empty, the intravenous catheter tube gets automatically blocked to prevent the back flow of blood.

FEATURES:

- Micro-controller based quantification and display of the infusion parameters
- Displayed infusion parameters: Flow rate (Drop rate), Drop count, Bottle volume, Time to empty
- User inputs: Bottle volume, Drops/ml
- Audio alarms for blockage, completion of drug infusion
- Reduces the need of frequent monitoring by the nursing staff
- Infusion data acquisition through USB
- Special features: Auto stop of infusion, Alarm for delay/interruption during infusion, Dual check based reliable monitoring

OXYMISER: OXYGEN OPTIMISER





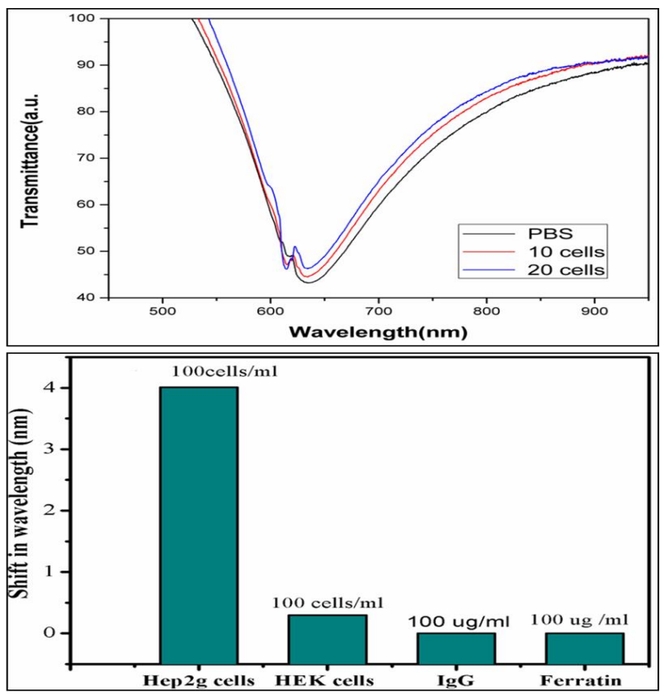
Portable oxygen sources like cylinders, concentrators are heavy, cumbersome and have limited capacity supply duration of Oxygen. Oxygen Optimiser manages to supply the Oxygen continuously for longer durations from such storages of limited duration.

FEATURES:

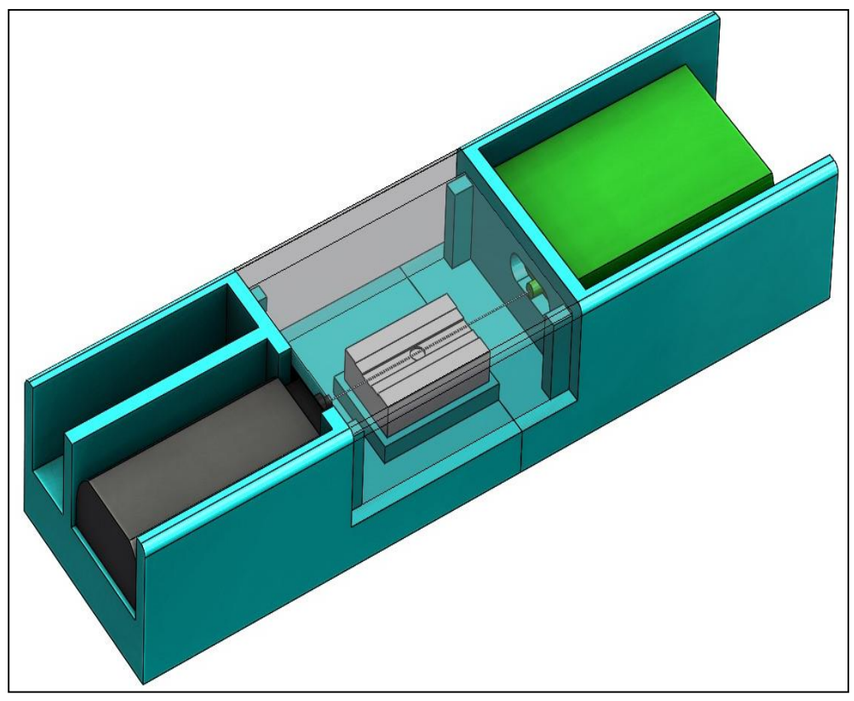
- Useful during oxygen shortage situations like COVID-19, higher altitudes and under water surfing.
- An active oxygen conservation device to reduce the consumption of oxygen during exhalation time of the patient during oxygen therapy
- Senses the inhale / exhale cycle of the user and controls the oxygen supply in the mask accordingly
- Disposable Breath sensor and mask combination
- User adjustable continuous oxygen flow parallel line for delivering constant amount of oxygen in the mask during exhale cycle
- Continuous 100% oxygen supply in case of any device malfunction
- Preserves up to 50% of oxygen in a tank
- User set parameters: Continuous oxygen flow rate
- Visual Indicators : Inhale / Exhale cycle, Safety alarms, Power ON/OFF
- Safety alarms for device malfunction

DIAGNOSTIC SYSTEM FOR DETECTION OF CIRCULATING TUMOUR CELLS

D-shaped SPR probe



Response & Specificity of SPR Sensor for CTC Detection



CAD model of Biosensor Setup

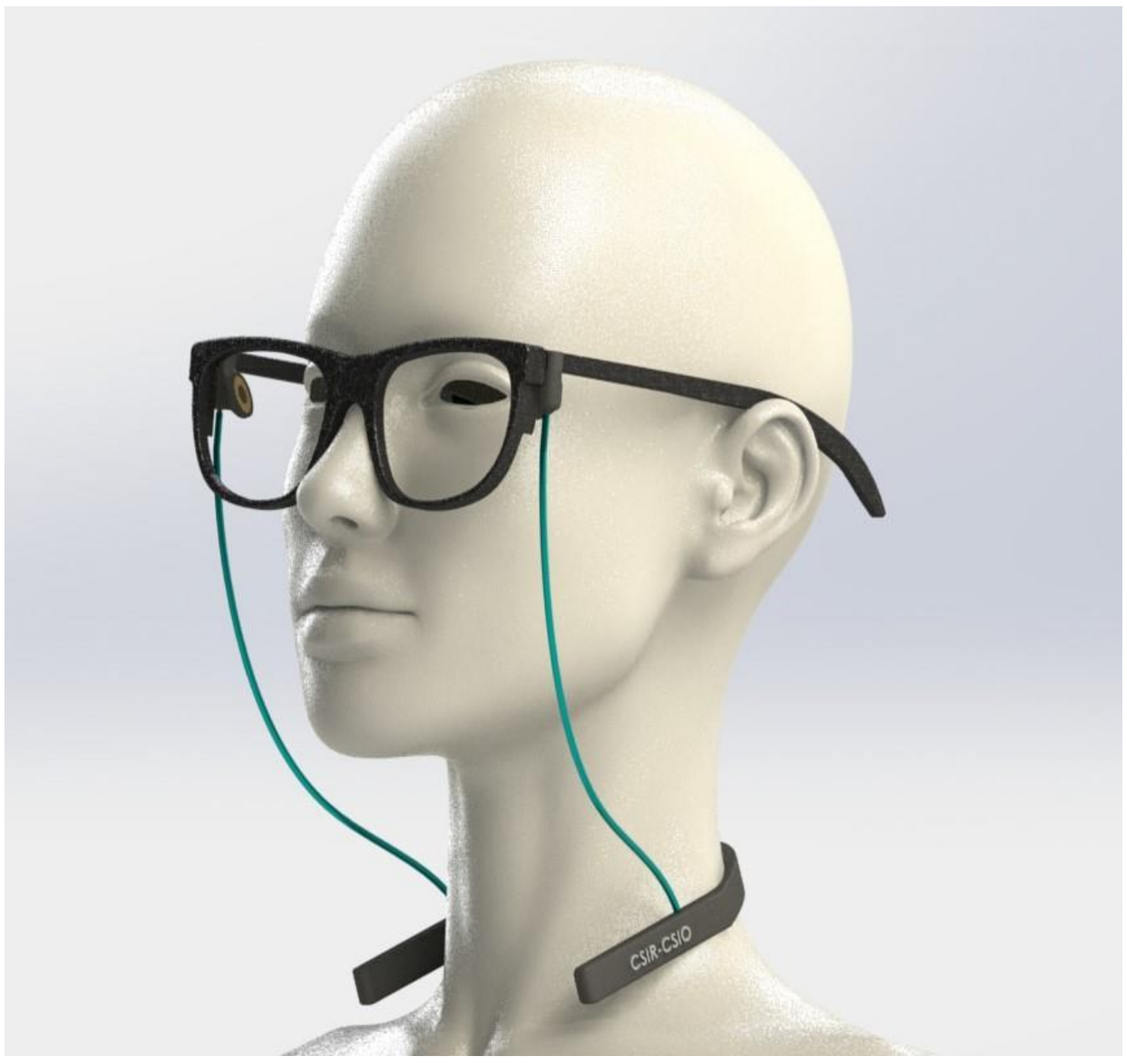
The Circulating Tumour Cells (CTC) in the blood are vital cancer biomarkers, its monitoring in blood stream can be very useful to screen abnormal cancerous cells. Especially in the early stages of cancer, typically 1– 100 CTC are detected per 10^9 blood cells. Therefore sensing of CTC is significant in the development of point-of care devices for early stage prostate cancer detection and management. The developed system is a fiber optic immune-sensing technique based point of care device for detection of CTC in prostate cancer.

FEATURES:

- D-shaped optical fiber based SPR sensing probe
- Highly sensitive resonance wavelength shift signal, offers direct and label free detection of CTC
- Nanomaterial-assisted bio-recognition of proteins molecules
- Can be useful for detection of other antigens by development of assays for the detection

Developed by CSIR-CSIO, Sponsored by CSIR, New Delhi

PORTABLE WIRELESS AUTOMATED EYE MOISTURIZING SPRAYER



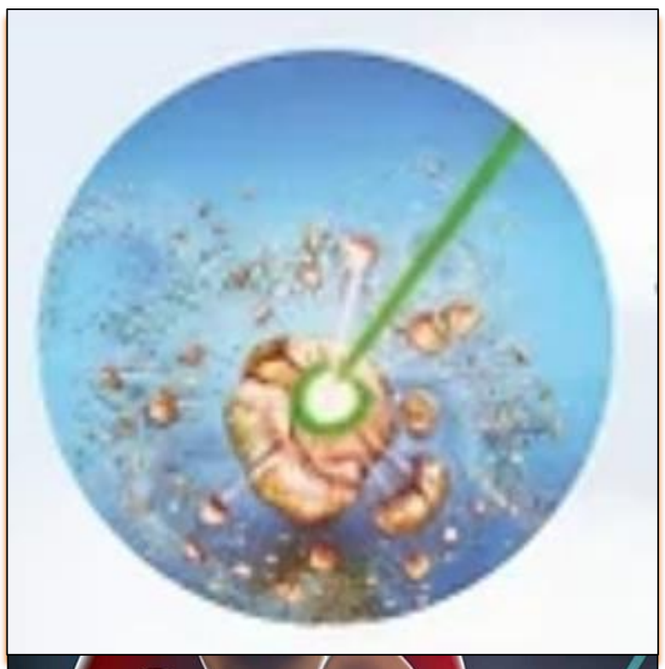
A portable, wireless automated eye moisturizing sprayer eyewear with an App based user interface which works more effectively than conventional eyedroppers in case of dry eye disease. While using ordinary eye drops, head is bend backwards uncomfortably to apply it and there is probability of germs present in the cap. The device is equipped with automated wireless piezoelectric based sprayer.

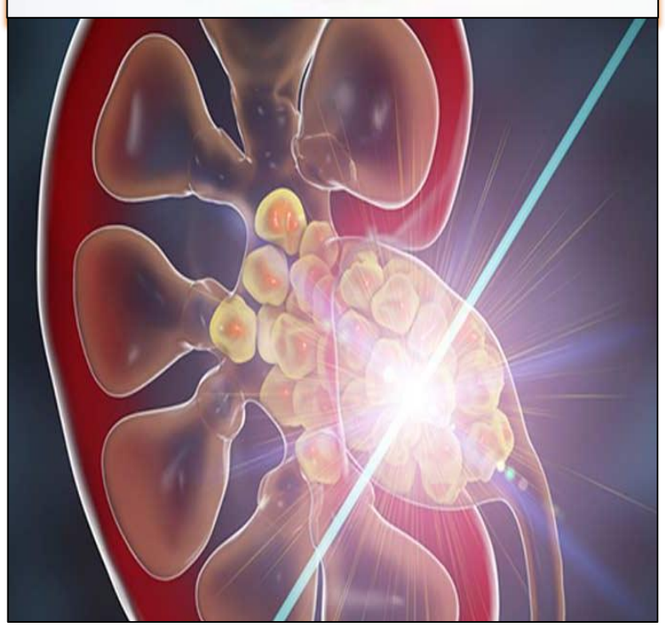
FEATURES:

- Moisturizes the eye in case of dryness
- Sprays controlled via Android/iOS based app on mobile
- Ergonomic shape makes it easy to fit
- Spray release by the press of a button in the user interface app
- No need to bend the head back
- Integrated moisturizing system in the spectacles
- Can be used with water as well as other eye medications
- Produces soft streams of diffused liquid innocuous to human eye

Developed by CSIR-CSIO, Chandigarh

LASER LITHOTRIPSY MACHINE





Laser Lithotripsy is the most common application of lasers in Urology to provide a painless treatment with high success rate and faster recovery time. A pulsed laser beam of special properties is used for ablation of urinary stones. Due to photo-thermal effect, the stone is fragmented into pieces which are washed out of the urinary tract.

FEATURES:

- Selectable energy and frequency range of aiming beam
- Green beam laser for better visibility
- Operate in both dusting and fragmentation mode using long and short pulse
- Effective for any size, location and hardness of stone.
- A non-invasive procedure
- Temperature controlled cooling system

Developed by CSIR-CSIO, Chandigarh & M/s Allengers, Derabassi, Punjab

ELECTRONIC APEX LOCATOR

An electronic apex locator is used in endodontics to measure the working length of root canals accurately and precisely. The apex of the root has a specific impedance to electrical current, and this is measured using a pair of electrodes typically hooked to the lip and attached to an endodontic file.

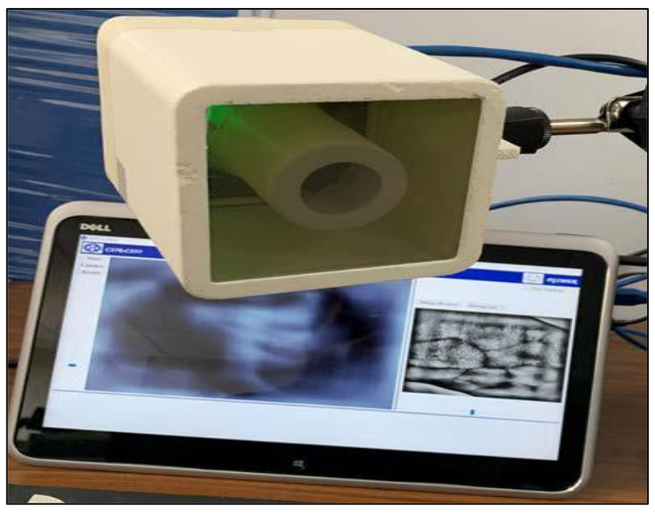
FEATURES:

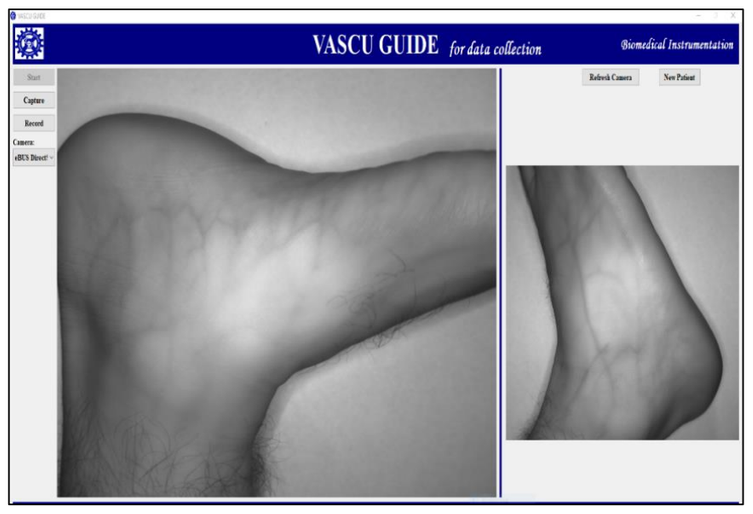
- Determines the position of apical constriction
- More accurate than conventional radiographs
- Operates in fluid environments
- Can detect bifurcated canals and peroration

Developed by CSIR-CSIO, Chandigarh. Clinical trials at GMCH, Chandigarh. Sponsored by DST, New Delhi

Imaging & Machine Intelligence based Technologies

VASCU-GUIDE:
VASCULAR SCLEROTHERAPY GUIDANCE AND ASSISTANCE TOOLS





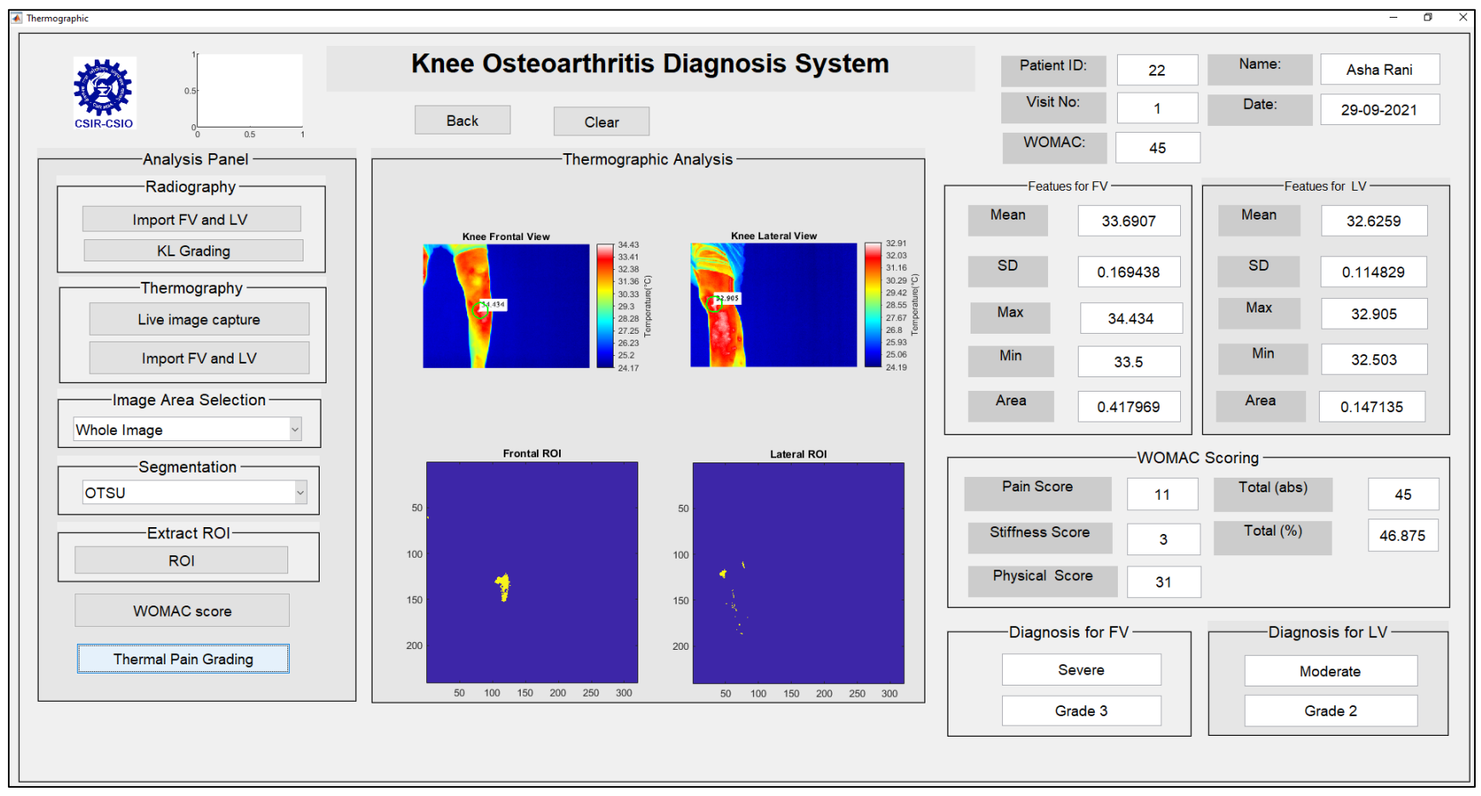
Conventional sclerotherapy approaches use ultrasound guidance have limitation to discover tiny superficial veins and clean visualisation of venous structure due to resolution. Further, during ultrasound sclerotherapy both hands of vascular surgeons remain engaged that could limit efficient interventions. The Vascu-guide has been specifically designed to provide visualization and guidance functionality with advanced assistive features for identifying vein morphology during vascular microsurgical operations specifically in sclerotherapy procedures. This will be helpful in assisting and guiding vascular surgeon for the treatment of venous malformations.

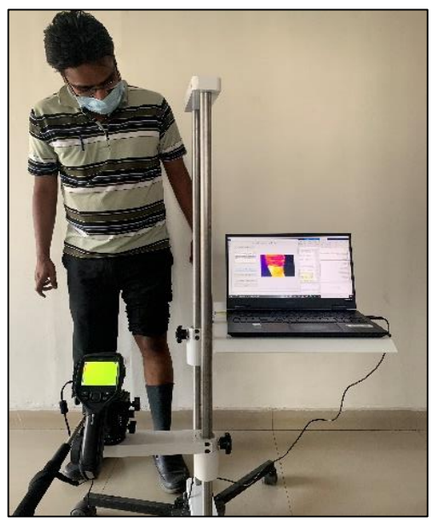
FEATURES:

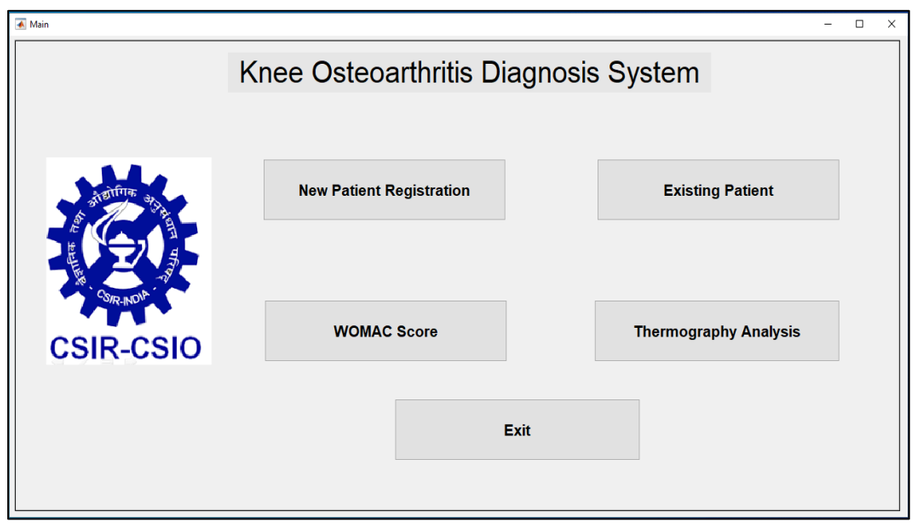
- Hands-free and non-contact design to improve surgeon productivity and accuracy during sclerotherapy treatment
- Detects, classify and visualize thin spider veins, deformed veins or feeder veins that are too shallow for ultrasound detection
- High-resolution vasculature information on large-screen with AI based assistive software tools for better treatment planning
- Image recording and analysis functionality for conveniently reviewing the status of the treated vein

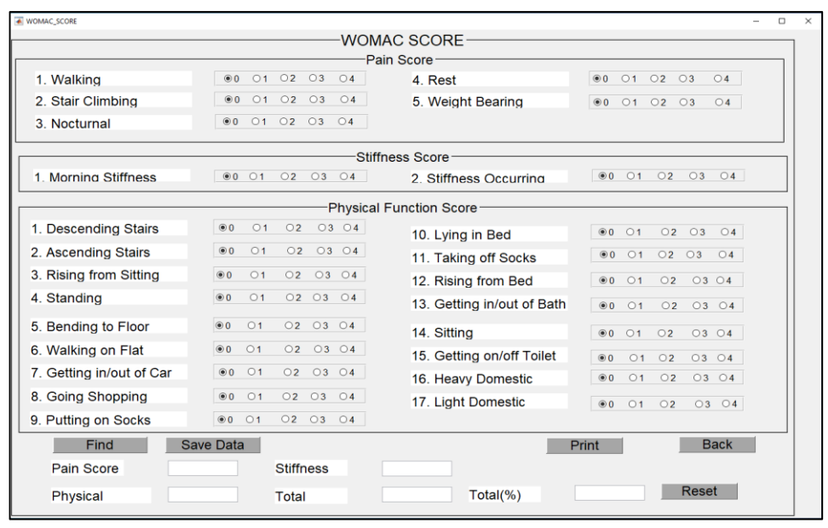
Developed by CSIR-CSIO, Sponsored by CSIR, New Delhi

THERMAL IMAGING BASED DIAGNOSIS SYSTEM OF KNEE OSTEOARTHRITIS









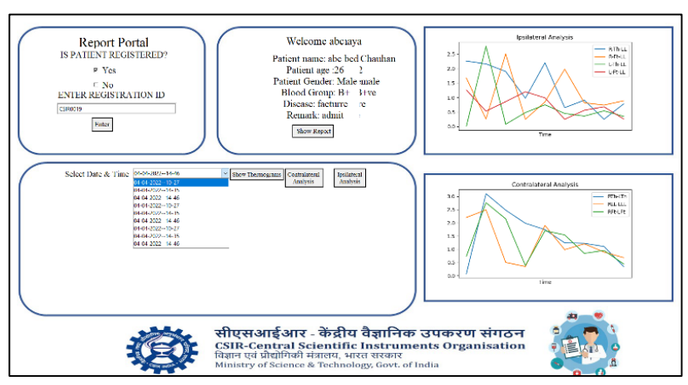
This is a thermal imaging based adjunctive tool for screening of knee osteoarthritis and grading of its severity. Osteoarthritis is a chronic disease causes degeneration of the cartilage without infection or special inflammation and is a major cause of pain. Current gold standards i.e. MRI, CT etc. for diagnosis of soft tissue injuries are expensive, bulky, involve ionizing radiations and and may not be suitable for every patient (MRI). As many pathological processes in the human body manifests it as local changes in temperature, thermal imaging can be a useful screening tool for diagnosis and treatment monitoring in soft tissue injuries.

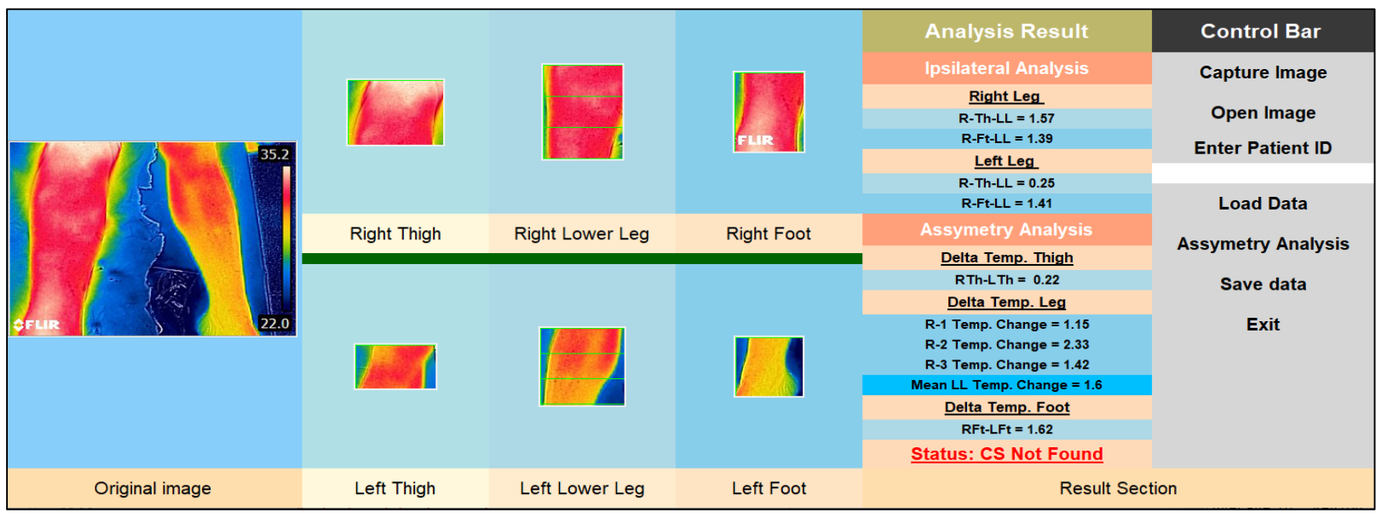
FEATURES:

- Non-invasive, No radiation & Pain, Offers privacy – no body contact
- High resolution IR Imaging (640×480);
- Integrated computing system with analysis & prediction
- Severity prediction comparable to conventional WOMAC method
- Ergonomic setup for ease-of-use in hospital or clinical environment

Developed by CSIR-CSIO, Sponsored by CSIR, New Delhi

NON-INVASIVE DIAGNOSIS SYSTEM FOR COMPARTMENT SYNDROME





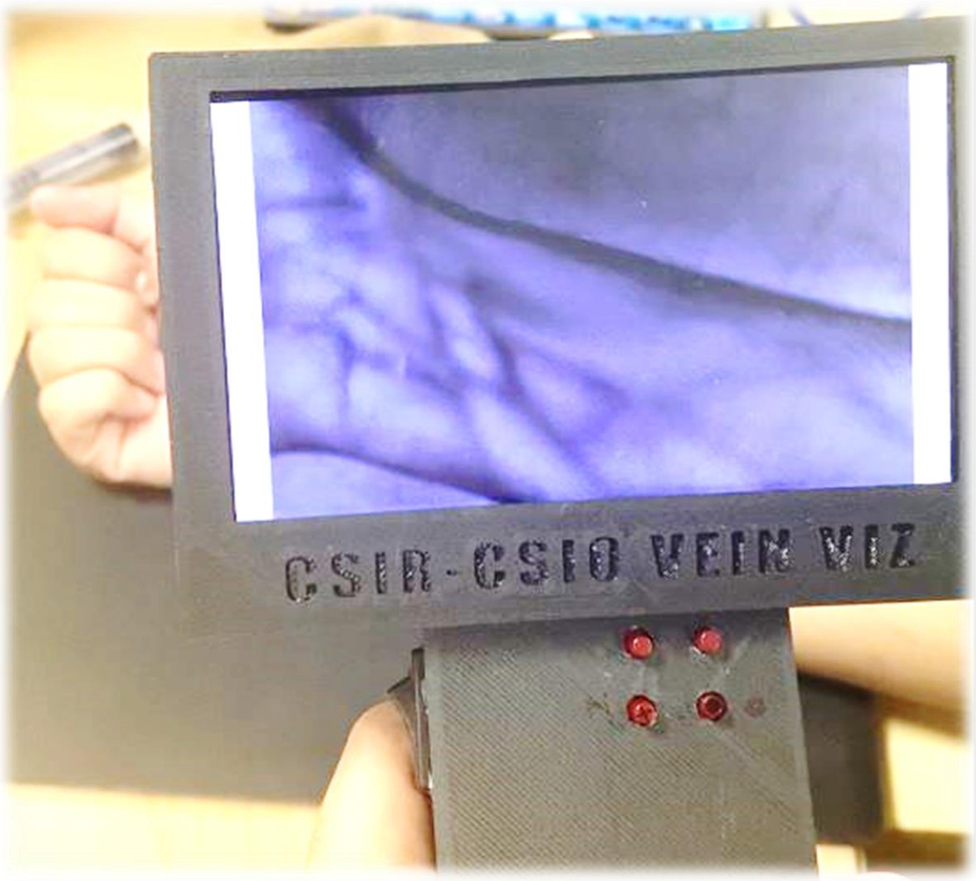
The developed system is a thermal imaging based non-invasive, computer aided diagnostic tool for Compartment Syndrome (CS). CS is a limb/life-threatening condition observed when perfusion pressure falls below tissue pressure in a closed anatomic space. Early detection of compartment syndrome is key to both management and treatment. Delays and indecision regarding the treatment of CS can lead to permanent damage/ limb amputation.

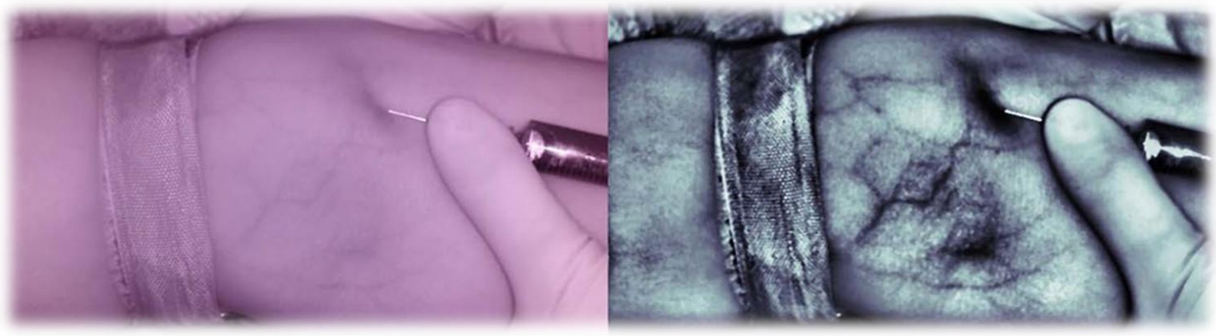
FEATURES:

- Non-invasive, Non-radiative
- Portable
- Integrated Computer-aided diagnosis

Developed by CSIR-CSIO, Sponsored by CSIR, New Delhi

VEIN-VIZ: IMAGE-GUIDED VASCULAR VEIN VISUALIZER





Real-time vein detection, localization and visualization device based on near infrared light and digital imaging, useful towards finding the clinically relevant difficult to access veins in children, obese and elderly.

FEATURES:

- Portable device for vascular vein detection and visualization
- Assist Phlebotomists and healthcare workers to improve patient experience by reducing number of sticks, lower catheter dwell time, and precise venipuncture avoiding associated complications
- Non-invasive & non-contact design
- Imaging based vein detection and visualization capability on screen with image recording option
- Determines the location of valves and bifurcations

Developed by CSIR-CSIO, Chandigarh. Trials sponsored by DST-SSTP

DRISTISCOPE:
AN OPERATING MICROSCOPE

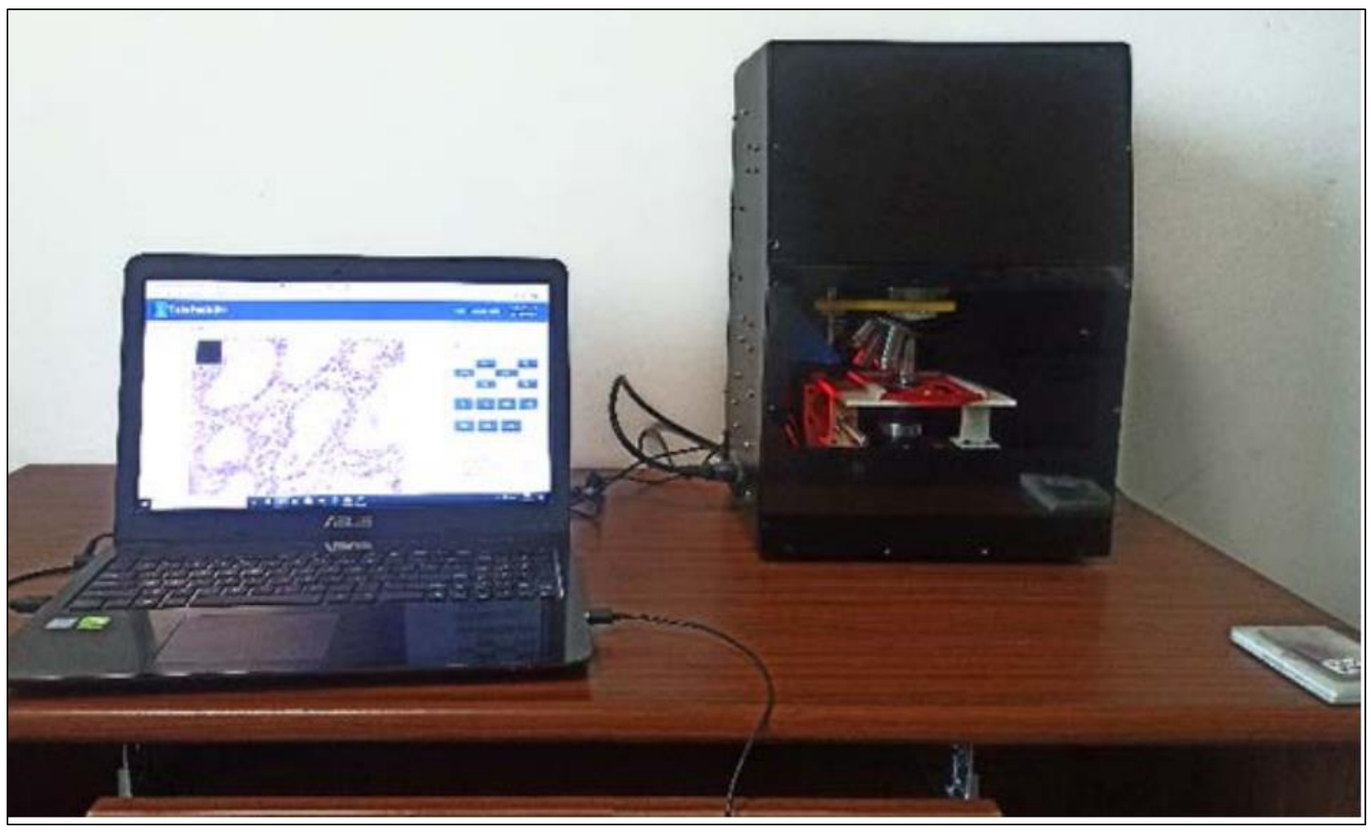
Dristiscope is primarily a medical instrument to assist the doctor for cataract surgeries and many other ophthalmic conditions. It is used for precision surgical applications like Keratoplasty, keratoprothitics and cataract operations. The design is on the principle of telescopic magnifier and five steps magnification.

FEATURES:

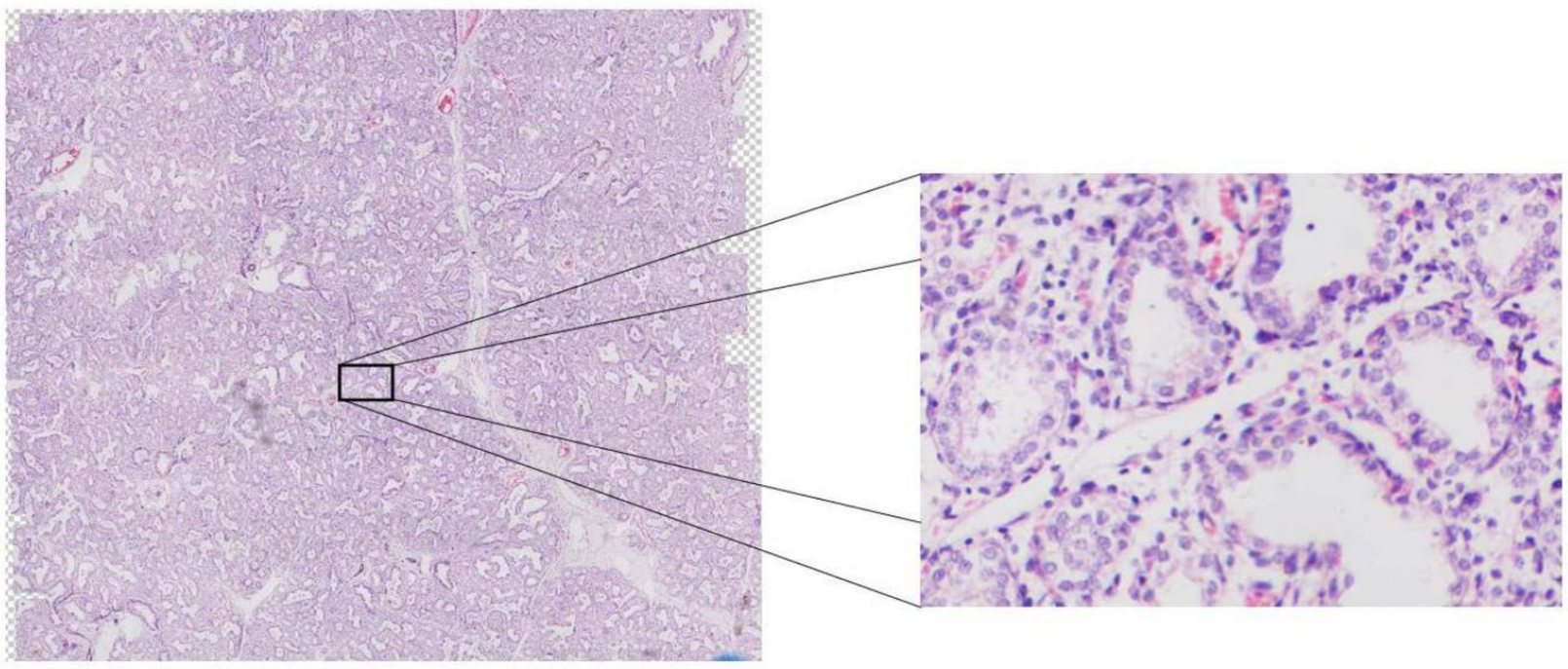
- Sufficiently large working distance between operating field and Microscope
- True stereoscopic observation for reliable acquisition of 3D view of object field
- Five steps Magnification : 3.6X to 22.5X
- Good resolution; adequate contrast; brilliant & uniform illumination of FOV
- Dual light source provision i.e. Halogen light and LED
- Blue & Yellow filters provision
- Coaxial illumination to overcome shadow & dimness of the FOV
- Fine adjustable inter binocular distance (56mm to 75mm)
- Motorized foot operated focus control (30mm in Z-Direction)
- Motorized binocular head movement in XY Plane (61mm x 61mm)
- Sturdy base with caster wheels supported movement

Developed by CSIR-CSIO, Sponsored by CSIR, New Delhi

PORTABLE MULTI-VIEW SMART MICROSCOPE – PMSM



Microscope is one of the most needed instruments for diagnostic evaluation and decision making but has a constraint of limited field of view during sample study. PMSM is a portable microscope that can acquire multiple field of views to create a bigger perspective of the sample under study. It has a slide-stage control system and GUI for acquiring microscopic images at various location of the slide.



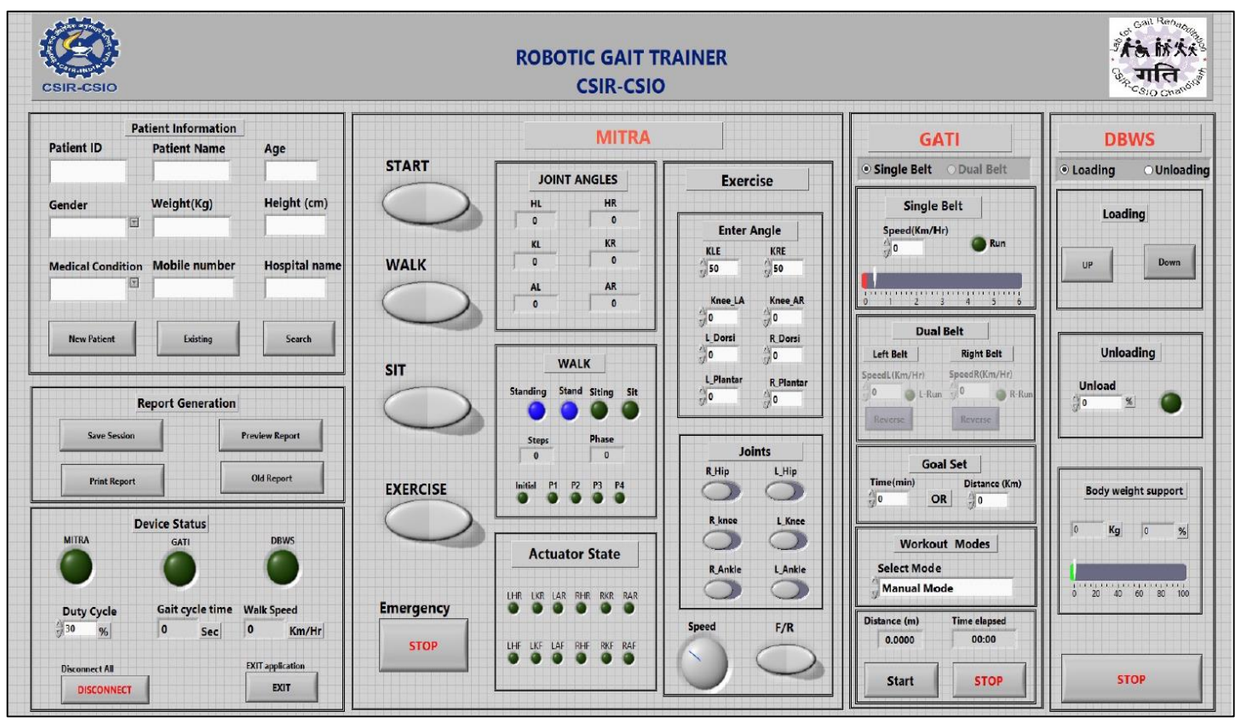
FEATURES:

- Portable standalone device - can be connected to any computer
- GUI as well as keyboard interface for XY stage control and focusing
- Image stitching of different field of views from camera software
- Secondary camera for gross view of the sample under microscope
- Automated slide movement and stitching of images to generate a larger field of view for diagnostics and reporting
- Digital images helps in repeatability and reproducibility of results

Developed by CSIR-CSIO, Sponsored by CSIR, New Delhi

Rehabilitation & Assistive Technologies

ROBOG: ROBOTIC GAIT TRAINER FOR REHABILITATION OF SCI PATIENTS



ROBOG Subsystems:

- Exoskeleton Device
- Body Unweighing System
- Gait Trainer Walkway
- Biofeedback system

Gait rehabilitation involves exercises and corrections that aim to improve one's independence in walking. Robot-assisted therapy is known to **produce 50% greater results than conventional therapy.** Neuro and Musculoskeletal therapists uses Robotic gait trainer.

SUITABLE FOR PATIENTS OF:

- Stroke, Spinal cord injuries, Parkinson's disease, Traumatic brain injury, Multiple sclerosis, Stiffness, Paralysis, Weakness caused by Nerve and Muscle related pathologies

ADVANTAGES:

- **Bodyweight supported standing** helps the patient to slowly adjust to standing after significant time in the wheelchair
- **Energy-efficient** as patients can practice a higher step count in the same time as compared to body weight support therapy on treadmill. It simplifies the process of walking independently
- **Posture correction, body alignment** of the lower back, hips and ankle alignment in all three directions using ROBOG
- **Quantification of progress** using seamless tracking of gait length, step count, speed and stride length over the course of rehabilitation. This helps to plan and reset the goals of therapy

Developed by CSIR-CSIO, Sponsored by CSIR, New Delhi

MITRA: MOBILITY ASSISTIVE GAIT DEVICE FOR REHABILITATION

Exoskeletons are the devices that reside in category of wearable robotics, is an external structural mechanism with joints and links corresponding to those of the human body. With applications in rehabilitation medicine and virtual reality simulation, exoskeletons offer benefits for both disabled and healthy populations. Exoskeletons device can be used as a capability magnifier or assisting device for Spinal cord injury patient, Stroke patients, elderly etc.

FEATURES:

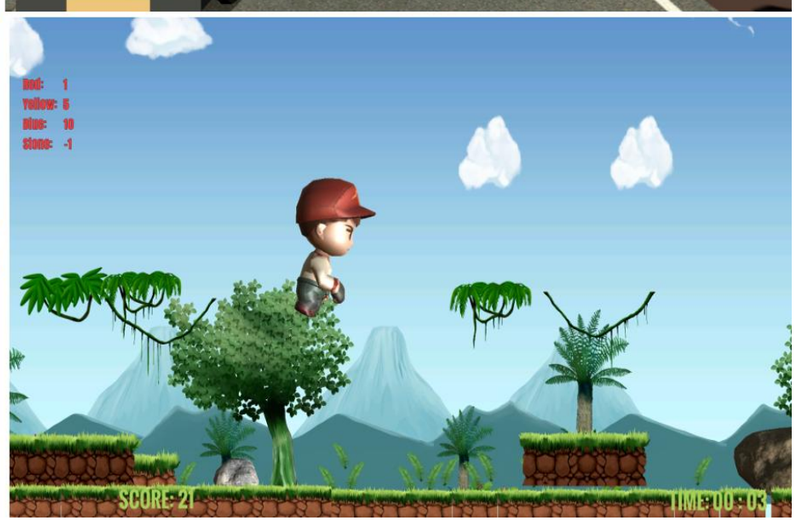
- 6 Degree of Freedom (DOF) augmentations, for one for each hip, knee and ankle joints
- Prime components: The Exoskeleton Suit, Control Hardware, Interfacing Circuit Board, Touch Panel and Power system
- Software modes: Sit-stand mode, Walk Mode, Therapy Mode, etc.
- Powered with rechargeable battery and can support 30 minutes of walking.

Developed by CSIR-CSIO, Sponsored by CSIR, New Delhi

VEERA: VIRTUAL REALITY BASED NEURO-MOTOR REHABILITATION SYSTEM

Therapy Modules

Augmented Reality Software Interface (ARIES)	
Standing therapy modules	Sitting therapy modules
Catch the carrot	Jungle runner
Fun fight	Dodge
Break the bricks	Break the bricks
Dodge	Reach the letter
	Fruit splash



VEERA provides patients a safe environment in which they can interact and develop goal and task-oriented activities within the functional virtual environments, especially in situations of cognitive, behavioral or motor disabilities.

SUITABLE FOR PATIENTS OF:

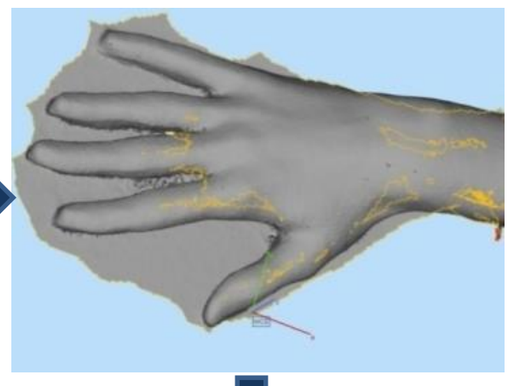
- Stroke, Spinal cord injuries, Parkinson's disease, Cerebral Palsy, Traumatic brain injury

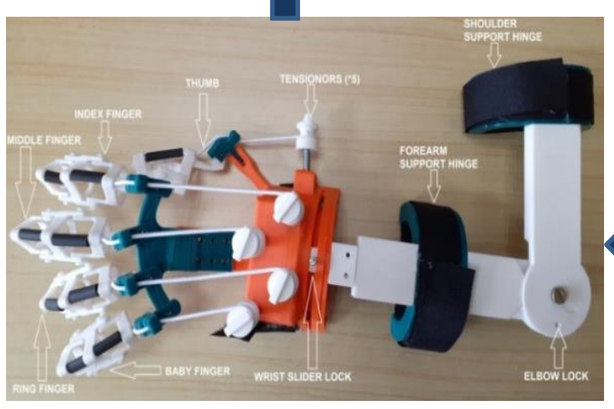
FEATURES:

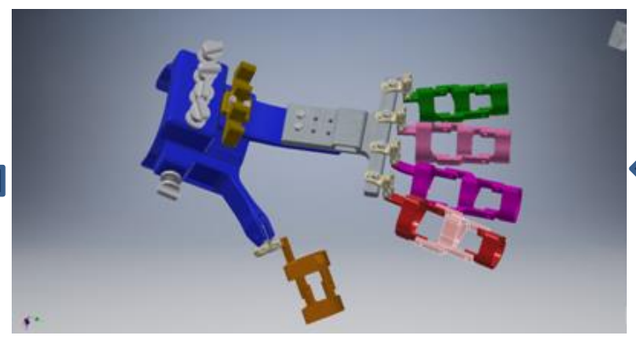
- Promotes recovery of functional motor abilities
- Disability Specific System
- Build Solutions reduce patient’s limitations of activity & participation
- Probable rehabilitation in home based environment
- Quantified Rehabilitation by inclusion of outcome measures
- Adaptable, Scalable and Affordable system
- Communication using Bluetooth, Non-immersive Display, Headgear
- Gesture recognition sensor: Kinect, Leap
- Motion recognition sensor: IMU
- Balance measurement through Balance Board
- LabVIEW based 2D exergames, Unity based 3D exergames
- Patient information & trials records

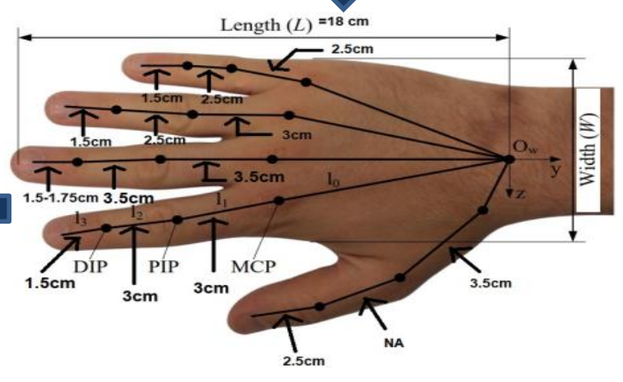
Developed by CSIR-CSIO, Chandigarh. Sponsored by MSJE, New Delhi

ORGAN: BIO MECHATRONIC REHABILITATIVE SOLUTIONS FOR CONGENITAL HEMIPARESIS CHILDREN

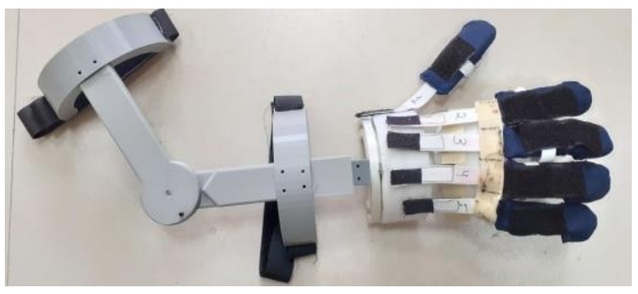








Hemiparesis is unilateral paresis, weakness of the entire left or right side of the body. Weak Range-of-Motion of effected limb in pediatric cases is caused by different medical conditions like Congenital causes, Trauma, Tumors and Stroke.

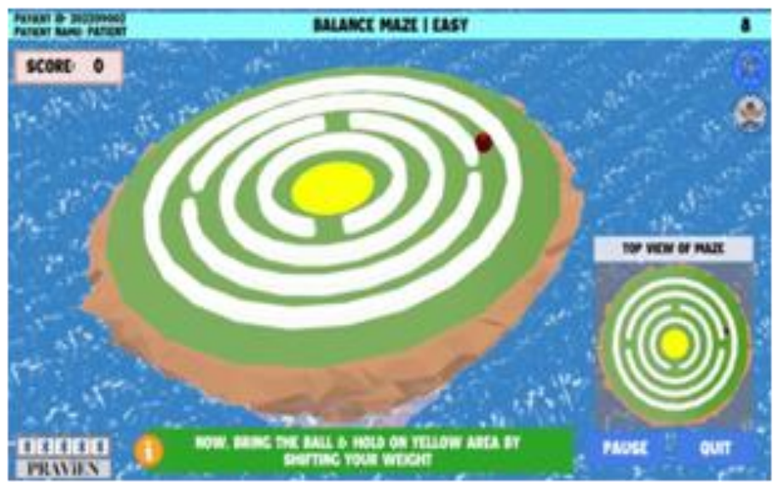


FEATURES:

- Customized orthosis with Elbow and Fingers Range of Motion
- Portable; Light weight with soft fabric at interior & exterior sections
- Economical with patient based aesthetics
- Extend-flexed, pronation, supination & neutral wrist positions
- Detachable, controllable & variable joint resistance phalanges
- Multi-profiled upper limb orthotic device and radial nerve splint
- Variable therapy regimes for quantified rehabilitation

Developed by CSIR-CSIO, Chandigarh. Sponsored by DST, New Delhi. Trials at PGIMER, Chandigarh

PRAViEN: REHABILITATION SYSTEM FOR ENHANCING WALKING ABILITIES IN CEREBRAL PALSY CHILDREN



Cerebral palsy (CP), is a neuro-developmental condition which causes motor disorders in kids accompanied with disturbances of sensation, perception and cognition. CP begins early in childhood and may persists throughout the lifetime. Children suffering with CP can catch up with their normally developing peers, if required targeted rehabilitation therapies are given. **PRAViEN** is a targeted systematic rehabilitation training system to enhance walking abilities in CP kids through rehabilitative activities in motivating, interactive & safe virtual environments with real-time biofeedback.

FEATURES:

- IMU based wearable sensing modules to extract real-time motor ingredients of lower limbs (over BLE 4.0)
- Software tools for assessment of lower limb active Range of Motion and quantification of rehabilitation
- Customizable training software modules with visual bio-feedback for improving lower limb range of motion through rehabilitative activities in motivating virtual environments
- Subject/patient specific training and assessment planning
- Embedded database for performance record keeping
- Software is customisable to operate with any IMU sensors available of the shelf.

Developed by CSIR-CSIO, Sponsored by CSIR, New Delhi

PROSTHETIC DEVICES

People who lose their limbs find it very difficult to perform various day to day functions. There are non-functional inexpensive cosmetic solutions are available but the functional solutions which assists the persons in carrying out various activities are expensive. Cost effective solutions for functional limbs for assistance in day-to-day activities have been developed.

FEATURES:

- Below & Above Elbow light weight Myo-electric arms
- Consists of gripping Fingers, Palm, Wrist, Elbow and mimic of required limb
- Prosthetic hand with variable opening speed and proportional grip force
- Remote switch controlled self-locking Elbow joint

FEATURES:

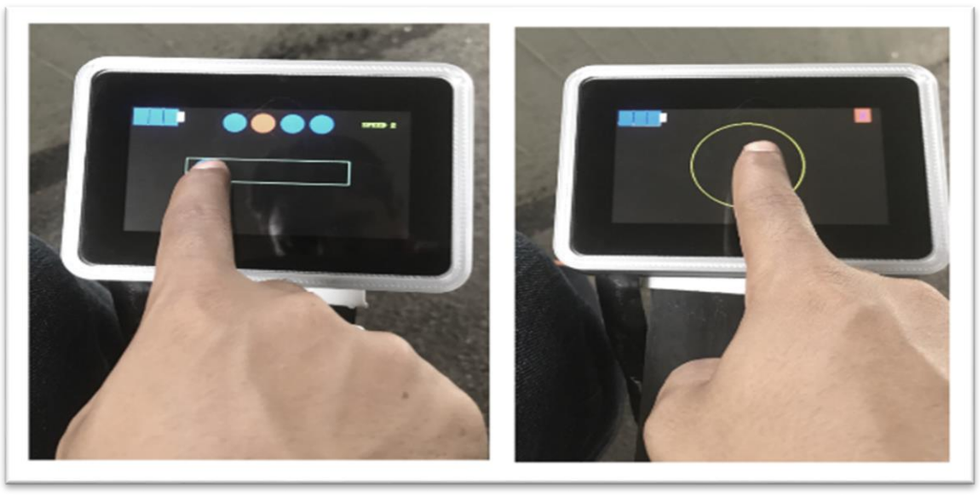
- Electronic Knee joint for trans-femoral (above knee) amputees
- For adaptive gait, the knee adapts to patient movement style in real time
- Fitment based on the location of limb amputation
- Three variants of knee: Electronic sensor based, Remote based and Mechanical based
- Controlled through control valve and sensors like Electro-goniometer, Force sensitive resistor and Accelerometer

FEATURES:

- Myometer with EMG electrodes
- Measures the value of EMG signal at the Amputee's residual stump
- Hand-held portable instrument

Developed by CSIR-CSIO, Chandigarh

GES-CHAIR: FINGER GESTURE BASED ALTERNATE DRIVE CONTROLLER FOR POWERED WHEELCHAIR



Sliding the finger on capacitive touch screen for maneuvering a motorized wheelchair independently is an alternate drive solution for paraplegics and elderly persons with weak upper limbs, when standard joystick is not the best option.

FEATURES:

- Easy to use sliding finger gesture based touch screen control module with graphics capability of speed control, lock screen & drive screen
- Has full driving capabilities like a physical joystick, including turning, veering and spinning around
- Compatible with motorized wheelchair
- Touch screen controller does not require force to activate and drive
- Device gets activated by the finger touch contact on the control screen
- Universal input capable with option of rear obstacle alert

Developed by CSIR-CSIO, Chandigarh. Trials sponsored by DST-SSTP

DIVYA NAYAN (A VIRTUAL EYE)
A PERSONAL READING MACHINE

Divya Nayan is a reading machine for visually impaired or illiterate person to listen texts of printed or electronic documents. User manually scans the document to be read by placing the machine over the printed document without knowing the direction of text flow. It uses optical character recognition technique to convert the image into text and convert text to speech with natural voice. The device is augmented with support for cloud based document processing, storage and sharing.

FEATURES:

- Stand-alone, portable, Wi-Fi, Bluetooth and IoT enabled
- Configured for English, Hindi, Tamil, Telugu, Kannada, Bengali, Punjabi
- Multifunctional (Read printed text, e-books, e-news)
- Can analyze a multicolumn document to provide seamless reading
- Equipped with USB, headphones, SD card
- Document storage and updates via cloud
- Page orientation detection and correction
- Capable of page, text and word level navigation
- Rechargeable Lithium ion battery

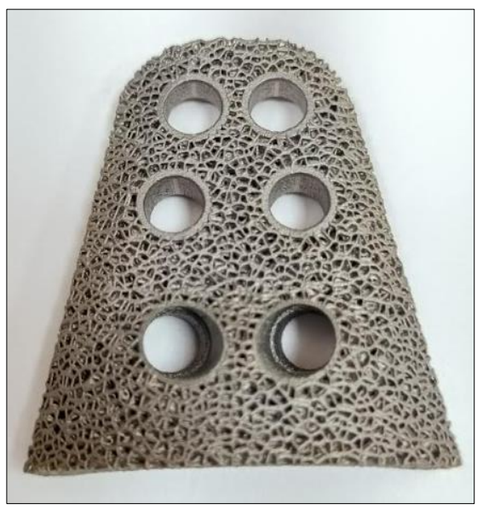
Advanced Manufacturing based Orthopedic Implants

ADDITIVE MANUFACTURED IMPLANTS: CONVENTIONAL & CUSTOMISED

CONVENTIONAL IMPLANTS:

- Made of solid metals mainly Ti6Al4V ELI biomedical grade titanium alloy
- Mismatch in mechanical properties of metal and bone causes stress shielding, loosening and failure of implants leading to revision surgery for replacement
- Engineered implants are manufactured using additive manufacturing, having trabecular/lattice structure using biocompatible grade alloy powders
- The rough trabecular/lattice structured surface provide biological fixation by promoting osseointegration between host bone and the implant
- The lattice structure reduces the elastic modulus of implants, thus decreasing the stress shielding effect and enhancing the life span of implants

Acetabular Cup



Buttress

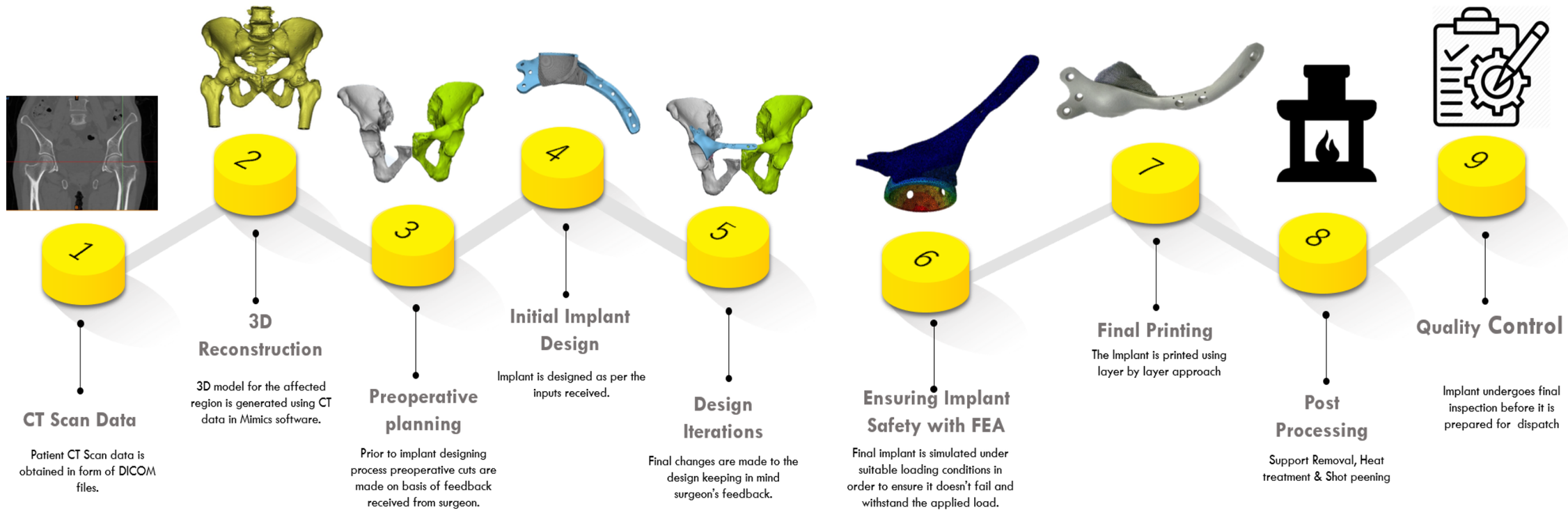
AVN

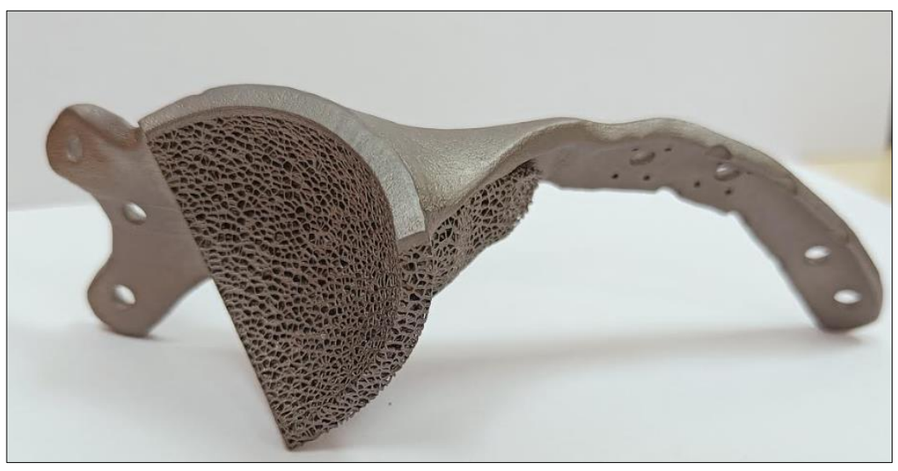
Spinal Cage

Shell Augment

CUSTOMISED OR PATIENT SPECIFIC IMPLANTS (PSI):

- In some cases, conventional implants cannot be used due to unconventional deformities or specific requirements of a patient





Customised Hip implant

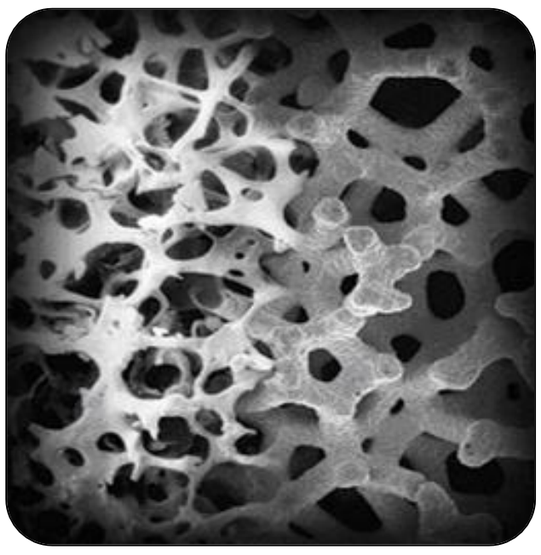
Mandible reconstruction

Customised implant for acetabular cup fixation

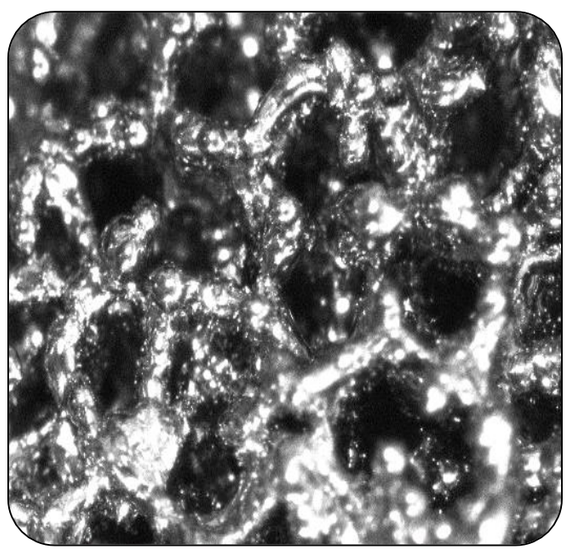
Developed by CSIR-CSIO, Chandigarh

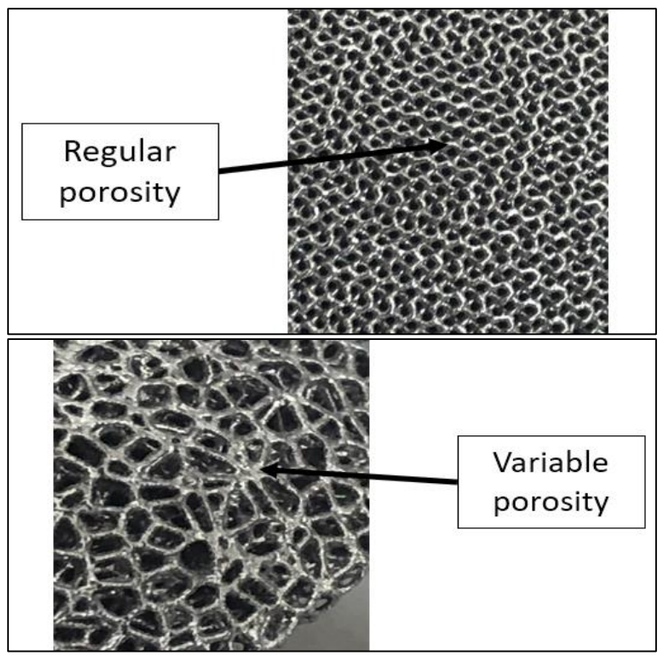
ADDITIVE MANUFACTURED PELVIS REVISION SURGERY IMPLANTS

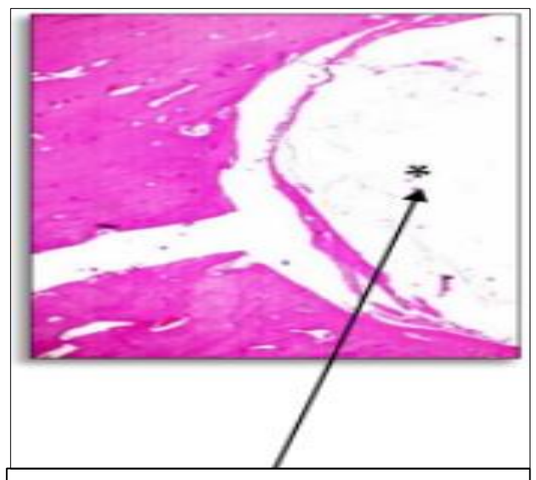
Bone Structure



Lattice Structure





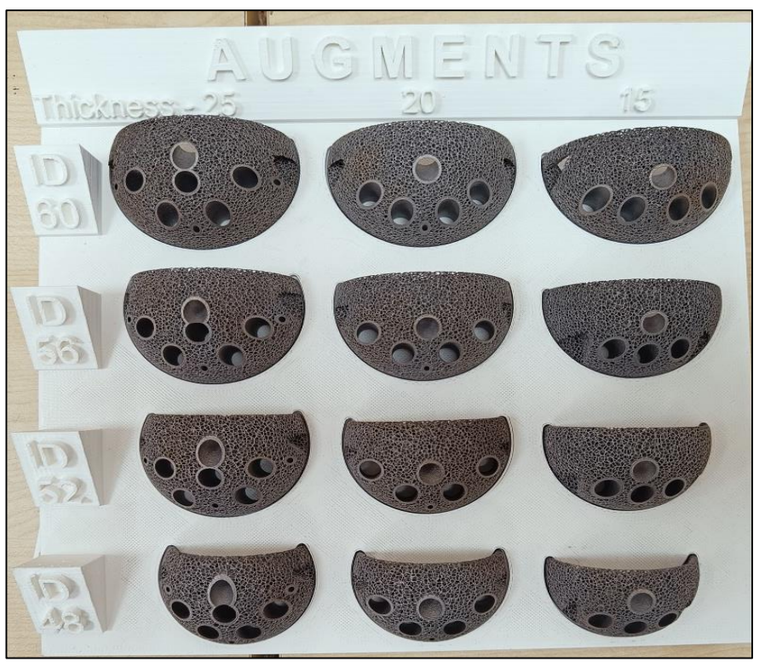


Asterisk showing new bony ingrowth at the implant site

Conventional implants are made of solid metals mainly Ti6Al4V ELI alloy. Mismatch in mechanical properties of Ti alloy and human bone causes stress shielding, loosening and failure of implants. This leads to revision surgery for replacement of implant . With the additive manufacturing technology, lattice/ trabecular structure can be manufactured that helps in biological fixation by promoting osseointegration between host bone and the implant. The lattice structures also reduce the elastic modulus of metal materials, decreasing the stress shielding effect and enhancing the life span of the implants.

FEATURES

- Shell augments are designed to act as a defect filling implant in the case of severe bone loss in the acetabulum.
- Buttress is designed to support the shell augments when the defect is spanned in large area.
- Shim Implants are designed to mate with the Buttress vis cement to raise the end of the buttress when pelvic geometries require support.
- Printed in Biocompatible Ti6Al4V ELI
- Highly porous surface, Young's Modulus of Lattice matching with cortical bone
- Reduced Stress Shielding
- Integrated solid and lattice interface
- Option of single or variable porosity
- Available in full range of sizes



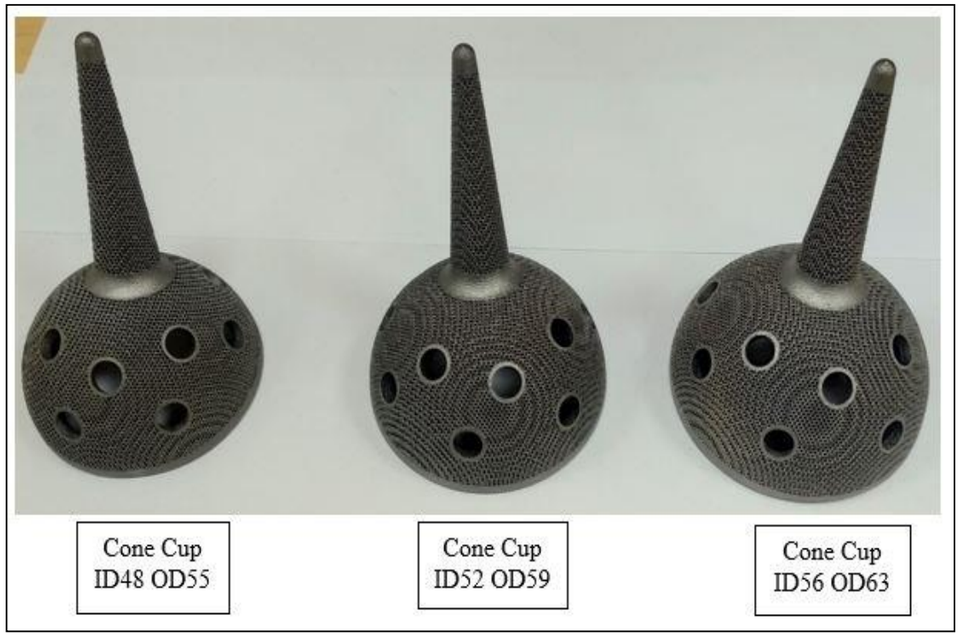
Shell Augment Implants

Buttress Augment Implants

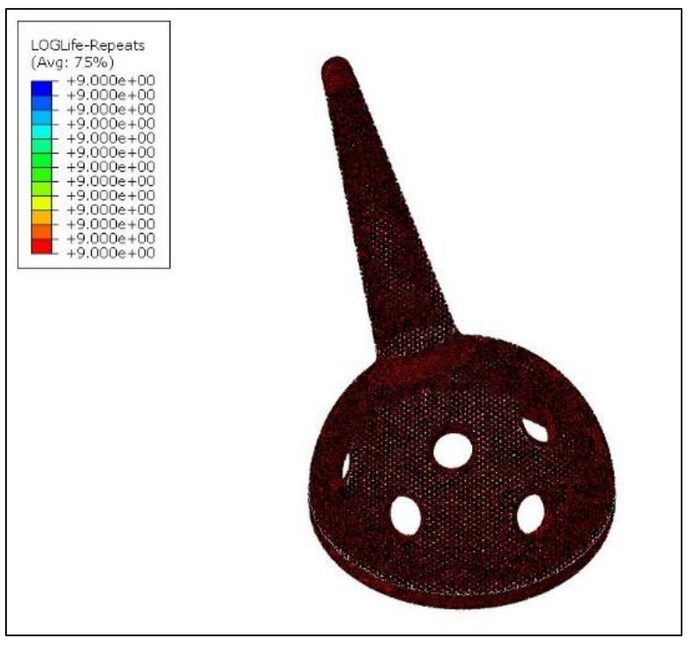
Shim Augment Implants

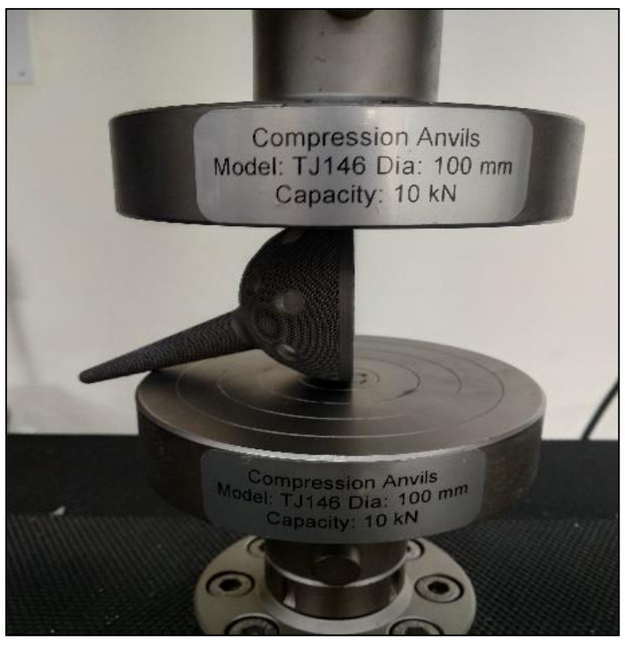
Developed by CSIR-CSIO, Chandigarh

LATTICE CONE ACETABULAR CUP



Cone Acetabular Cup in full range of sizes





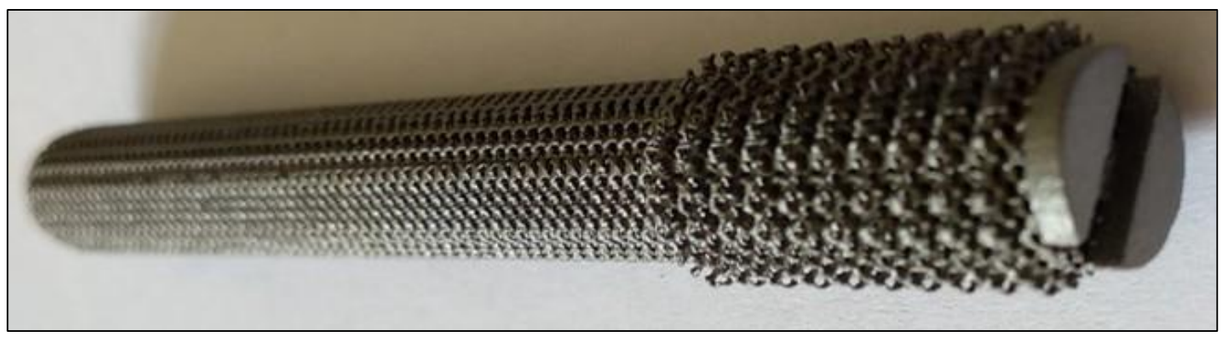
Mechanical tests meeting required 3kN load capacity

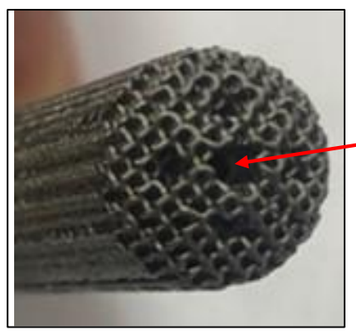
Pelvic reconstruction due to peri-acetabular tumors, revision surgeries and trauma is a challenging task. Due to substantial bone loss conventional acetabular cup are unfit to provide solution. The implant developed is additive manufactured in biocompatible grade Ti6Al4VELI material with bone structure optimized for bone ingrowth, providing biological fixation. The Lattice Cone Acetabular cup is available in various sizes to fulfill the individual patient requirement. The lattice Cone Acetabular cup can effectively be used in situation where substantial bone loss is there in acetabulum region without the need of custom implants.

FEATURES:

- 3D printed with pore structure optimized for bone ingrowth
- Highly porous surface
- Young's Modulus of Lattice surface matching with cortical bone
- Reduced Stress Shielding
- Printed in Biocompatible Ti6Al4V ELI
- Integrated solid and lattice interface
- Option of single or variable porosity

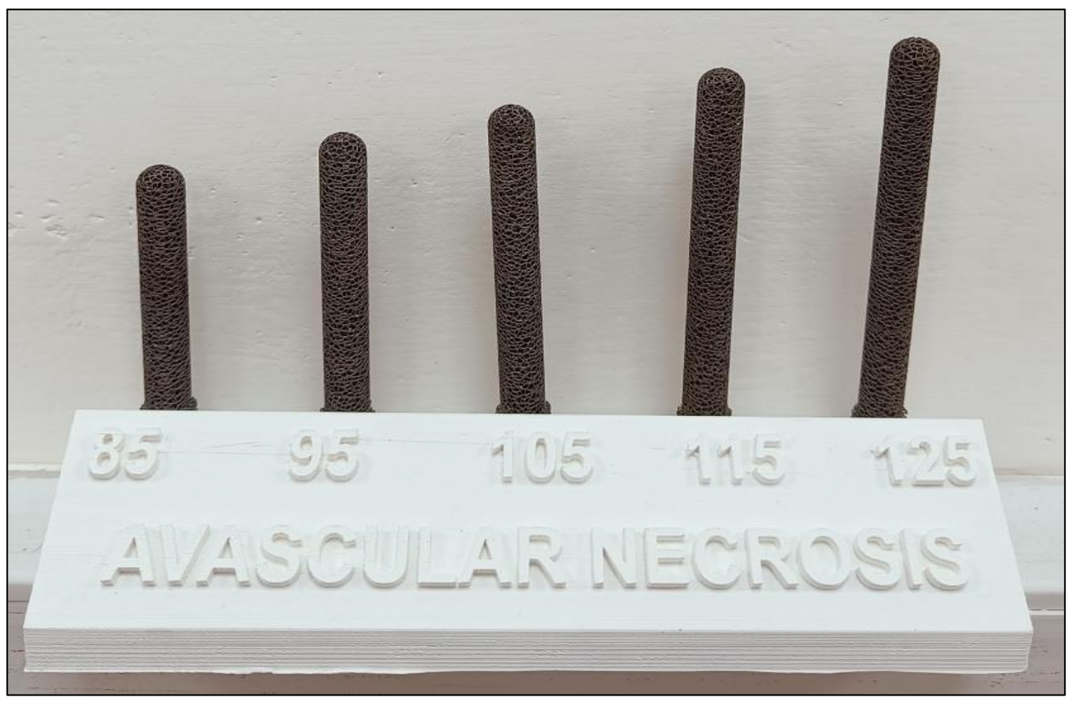
AVASCULAR NECROSIS (AVN) IMPLANT





Cannulation core

AVN Implants



Osteonecrosis of the femoral head (ONFH) is a hip disorder characterized as collapsing of the femoral heads and secondary osteoarthritis. Avascular necrosis (AVN) of the femoral head is caused by the interruption of blood supply to the bone of the proximal femur. The treatment of AVN varies according to the stages of AVN. The implant has a solid core which can be used for cannulation as well as for delivery of bone marrow concentrate at the targeted site. The AVN implant can be used for treatment of osteonecrosis of the femoral head (ONFH), of stage I & II.

FEATURES:

- 3D printed with pore structure optimized for bone ingrowth
- Highly porous surface
- Young's Modulus of Lattice surface matching with cancellous bone
- Printed in Biocompatible Ti6Al4V ELI
- Integrated solid and lattice interface
- Provision for cannulation
- Available in various sizes for individual patient requirement

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