



4i LAB

4i - LABORATORY

.INNOVATION .INTEGRATION .INCUBATION .IMPLEMENTATION

Indian Institute Of Technology
Kanpur

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Coordinator, 4i Laboratory
IIT Kanpur

INNOVATION
INTEGRATION
INCUBATION
IMPLEMENTATION



Outline

- Vision of 4i laboratory.
- Major Facilities.
- Support provided by 4i lab.
 1. *Undergraduate Projects. (Academic/ extracurricular)*
 2. *Post Graduate Projects. (Academic/ extracurricular)*
 3. *Sponsored/ consultancy projects.*
 4. *Curriculum development*
- Future targets for the next two years.
- Conclusion

Vision Statement of 4i Laboratory

- The 4i laboratory will provide innovative technical solutions to industry and institute and will provide technical support for student and research projects and will help in developing hands on innovative curriculum.

Highlights of Facilities at 4i Laboratory



The epilog laser machine is a CO2 laser system that can print on wood, glass, plastic and metal with a resolution of 10 microns.

The Deckle Maho is a power milling system with an overall bed-size of 630mmX 500mmX500mm. It is loaded with CAM coading facility and can go upto 10000 rpm which makes this machine in high industrial demand



The Rapid Prototyping machine from FDM Titan is a 3-D printing system for Polycarbonate and ABS plastic and has a layer thickness of 150 microns.



The CNC turning centre can hold a very large job o size diameter (305mm) and length (600mm).

Highlights of Facilities at 4i Laboratory



The Omax water jet machine has the capability to cut complex contours and has a minimum cut size of 0.7-1 mm and an overall bed-size of 26 in X 52 in.



The Rolland Scanner can scan an object of maximum size 260mm X 400mm.

The Electro-discharge machine from Electronica can produce mirror images of small dies with discharge machining.



The PCB facility comprises of a Milling tool, mask making, electroplating facility

Highlights of Facilities at 4i Laboratory



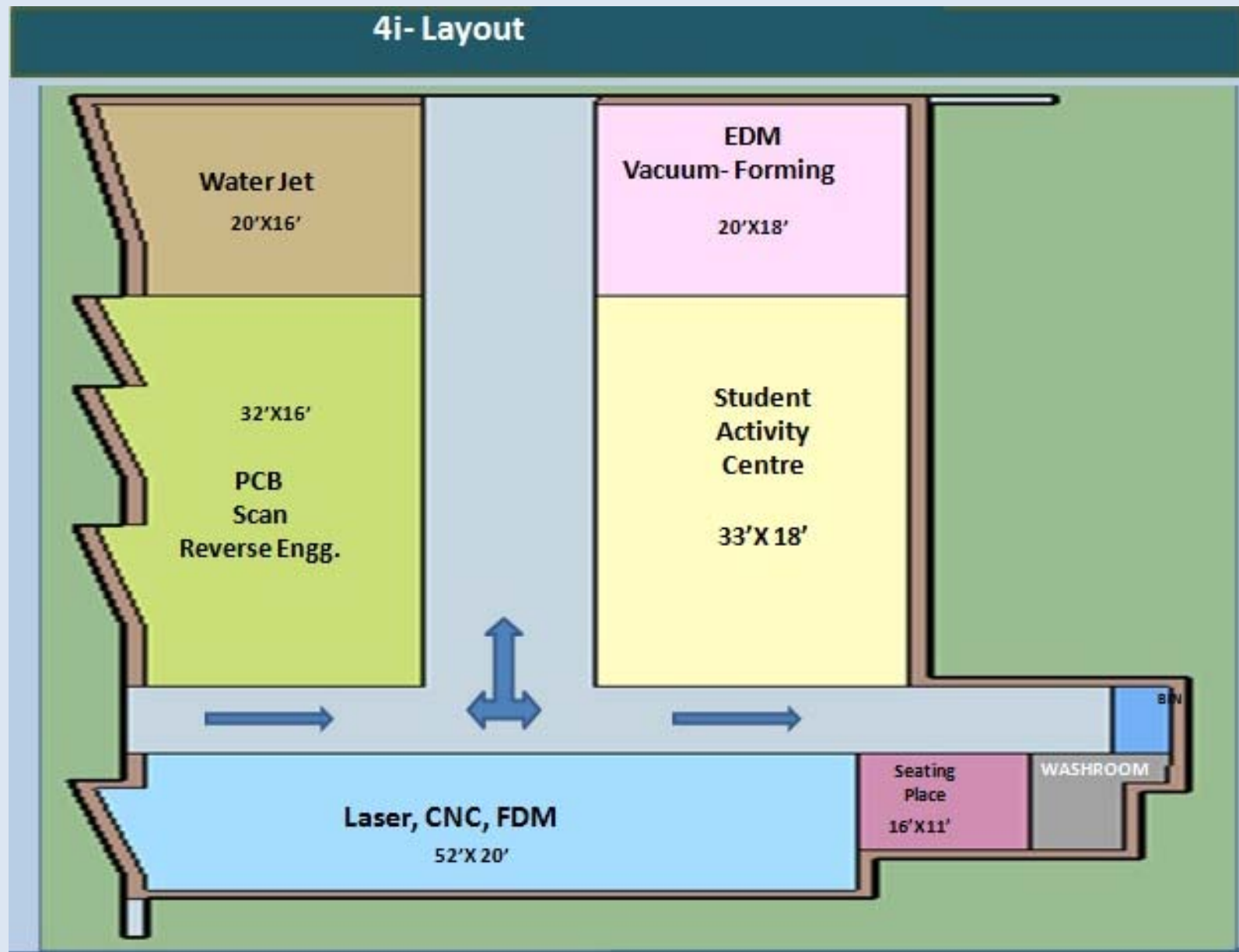
The Ezeedrill is a EDM drill and is capable of high aspect ratio drilling with minimum bit size of 500 microns and a maximum depth of 50mm.

The vacuum forming equipment is a equipment for plastic packaging around different object forms through polycarbonate

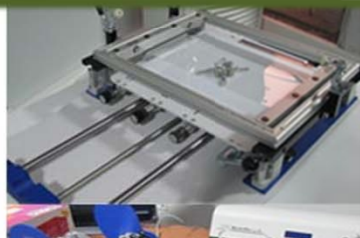


The BMXP is a CNC wire cut EDM machine with a capability to produce upto 3 mm size parts.

Dimensioned Layout of 4i Laboratory



BIRDS EYE VIEW OF ALL EQUIPMENTS



- Personnel = 04 + 01 COORDINATOR
- Machining centers = 21

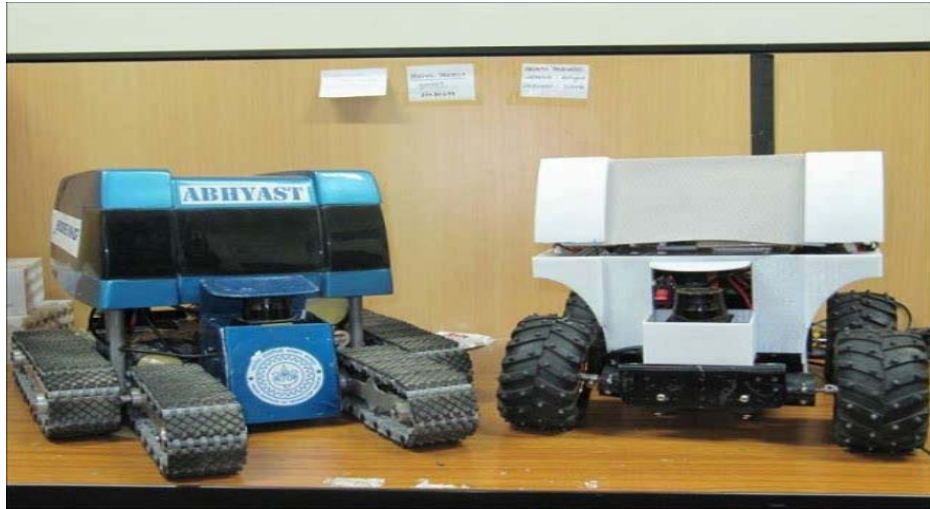
Glimpses of 4i-Innovation support for Major UG and PG Research / Sponsored Projects/ Curriculum Development

- Support for UG projects
 - ABHYAST (BOEING), ROBOCON, SAE
- Support for PG projects
 - UAV.
 - Dental Chair. [Collaborator: SPPGSDMS, Lucknow, PUJ Columbia]
 - Space design problem. [Collaborator: PUJ Columbia]
 - Micro-pillars on water-jet system.
 - Part for neurosurgery (Intervertebral body fusion device)[Collaborator: Dr. Mohd. Kaif, Neurosurgeon, Sahara Hospital]
 - 3-D model of Blood Injecting Device [PI: Dr. Panda]
 - Low cost UV Water Filter
- Course Innovation
 - VLFM, DES 682, Outreach training to Industry and Local Engineering Colleges

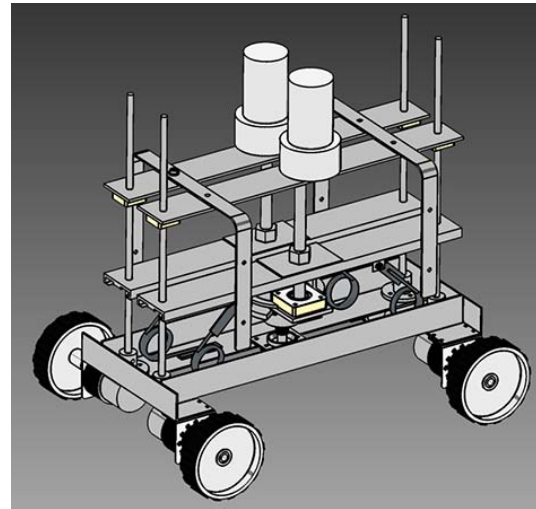
ABHYAST

A joint activity of IIT Kanpur and Boeing

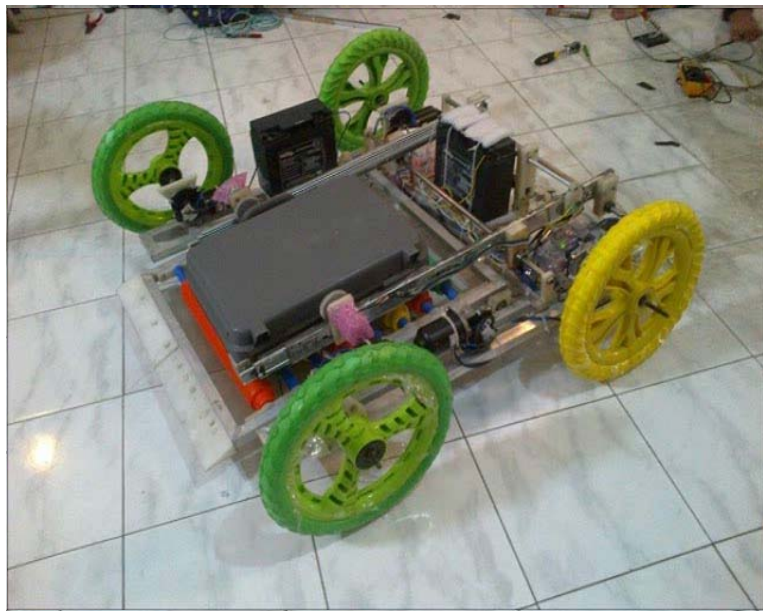
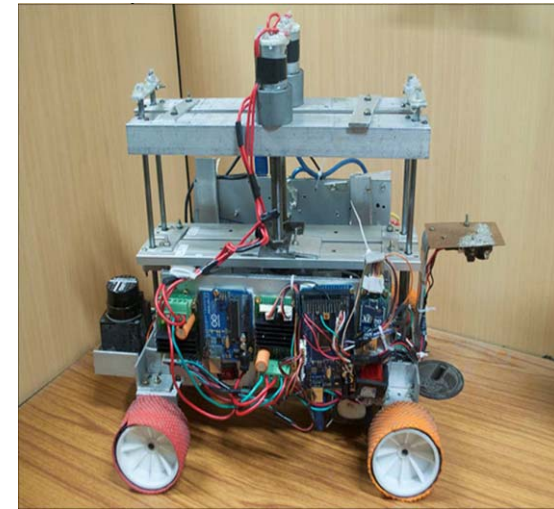
Autonomous Navigation System (ANS): Capable of localizing itself and navigating to destination while obstacle avoidance (PI: Shantanu Bhattacharya)



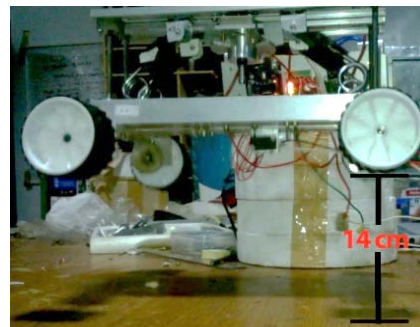
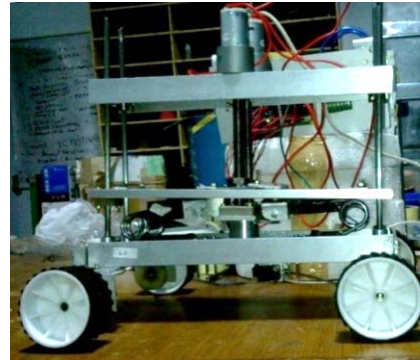
Phase 1 and 2: Rough terrain vehicle with obstacle avoidance



Phase 3: ANS with jumping capability



Phase 4: Wirelessly controlled Robot for disposing suspicious objects

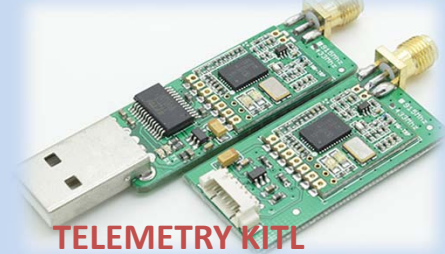


Boeing National Aeromodeling Festival

➤ Boeing Autonomous Air Vehicle Program



AUTONOMOUS QUADCOPTER



Electronic speed controller



ROBOCON



Students working at 4i-lab



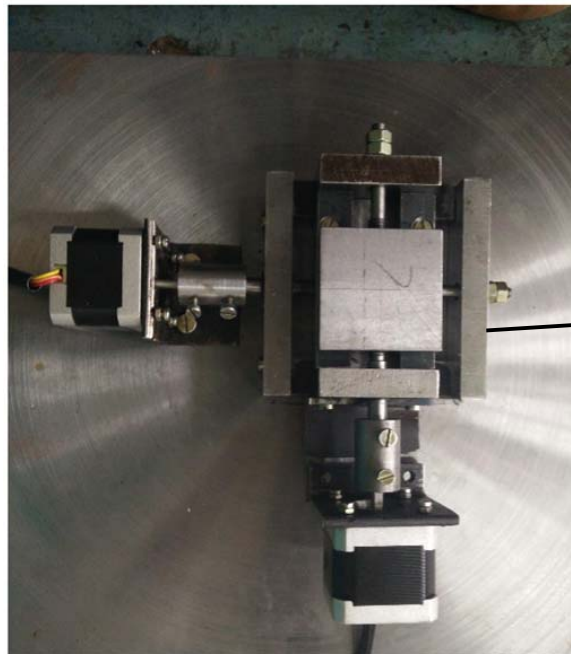
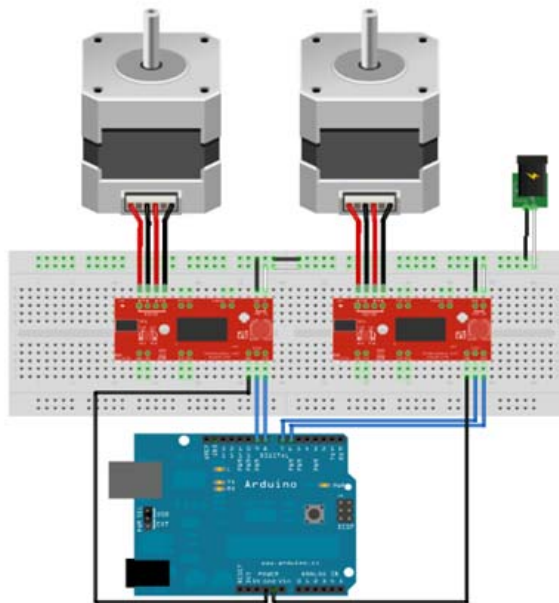
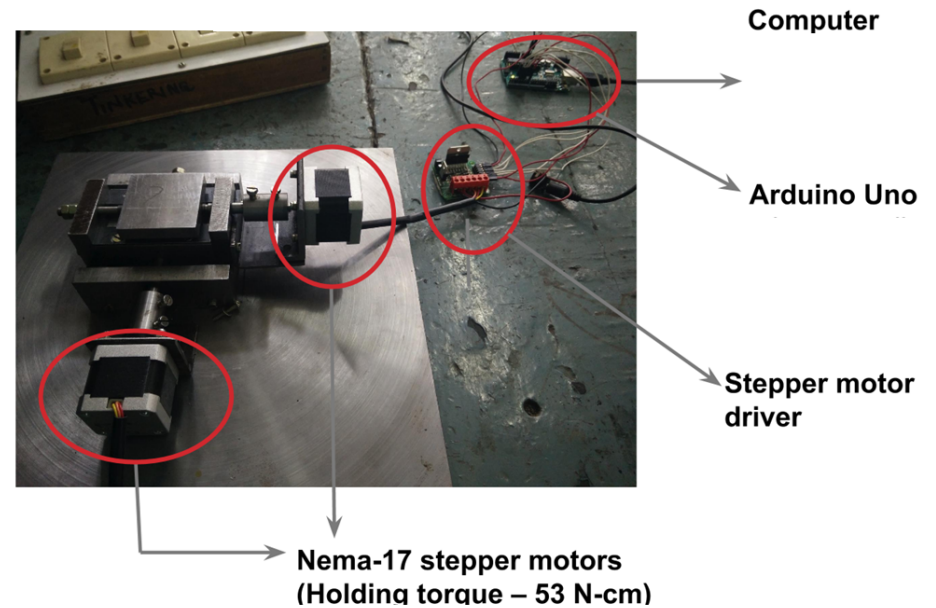
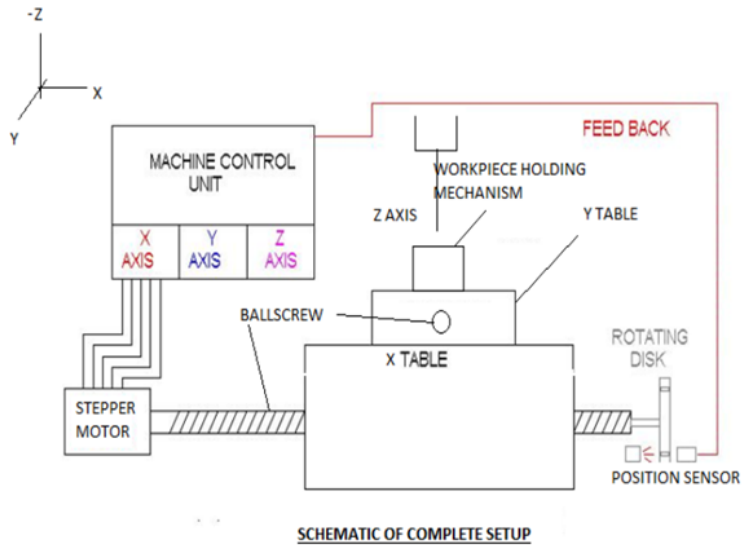
Badminton Playing ROBO

SAE activity



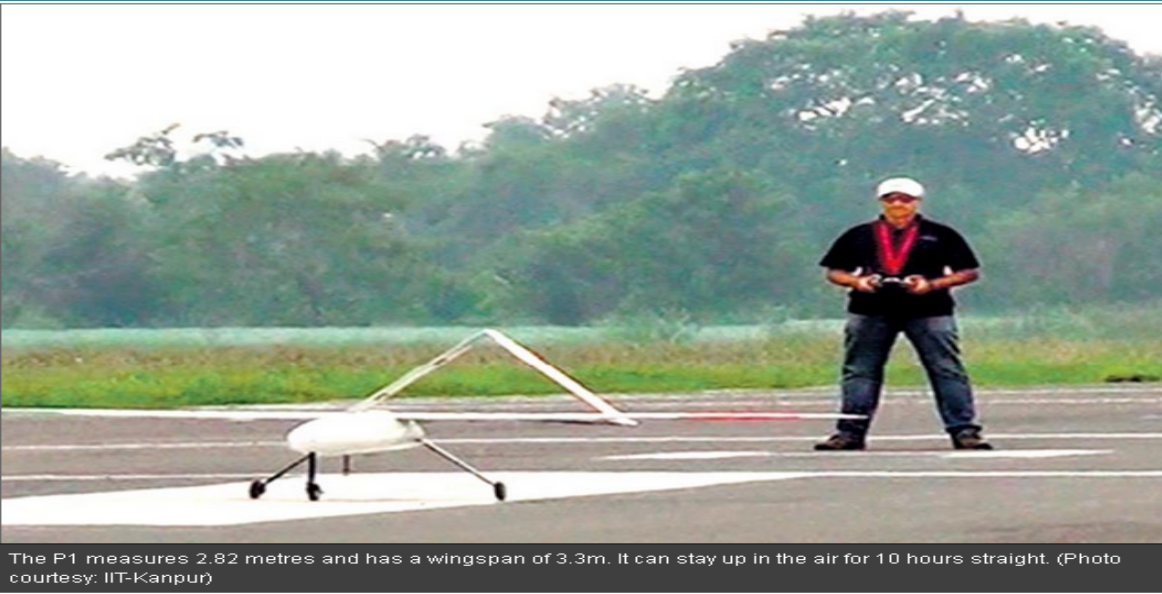
Parts made at 4i-lab for SAE

- To design and fabricate a worktable for EDM drilling, to be used in 4-i lab



PG innovation support/ Sponsored research work at 4i

Unmanned Arial Vehicle Program (PI: Prof. A.K. Ghosh/ Prof. D. Philip)



The P1 measures 2.82 metres and has a wingspan of 3.3m. It can stay up in the air for 10 hours straight. (Photo courtesy: IIT-Kanpur)

According to the UAV team there is a confidence in making commercial grade parts for 50-60% of the parts at 4i Lab.

■ Hover craft development.
This was an initiative by M.Des. Students who won Third place in the national

Space challenge competition Organized at IIT KGP. The fabrication was done at 4i lab.



DENTAL PROJECT WITH INDIAN CONTEXT

A COLLABORATIVE ACTIVITY WITH PUJ COLUMBIA FOR ME310 COURSE AT STANFORD

RE-DESIGN THE DENTAL EXPERIENCE IN INDIA



60%
OF INDIA
doesn't have access
to dental facilities



THE PROBLEM

People in Indian Villages do not have easy access to dental facilities. They have to travel long distances to reach dental clinics which means they have to spend all day going to the dentist to get treatment.

70% of india
is rural

THE GOAL

To reach Indian mass population by making a dental system that is easier to produce and establish, which brings benefits to dentists and patients.

Generate a link between the patient and the dentist to make the experience more personal and to begin to create awareness among Indian mass population.

THE DENTAL SYSTEM

9. Sound

What if the patient could be transported to a different place while being treated?

8. Head rest hole

Allows the women to feel more comfortable if they have their hair tied up

7. Attachable tray

This attachable tray allows the dentist to have easy access to all the equipment.

1. Kinect light

What about a light that could follow the patient's mouth wherever he/she moves.

2. Neck rest

What if the patient doesn't have to suffer from neck pain. The neck pillow adapts to the patient and keeps him/her comfortable.

3. Arm rest

Adaptable arm rest that supports the patients arms

4. Back rest

Extra cushion for patients back



7. Dentist chair

This ergonomic design would make the dentist feel more comfortable.

6. Foot control

It consists on a pedal that manages the entire unit system (up, down, back, forward)

5. 2 sided Spittoon

Easier to reach for the patient. The cup goes to the patient, instead of the patient leaning over to spit

The Dental chair



The Dentist stool



Spittoon and Light



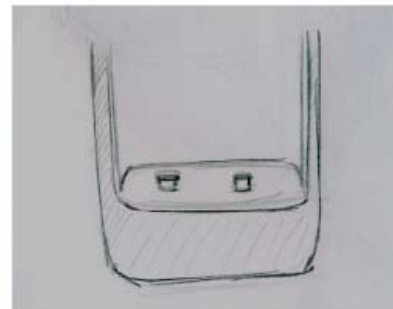
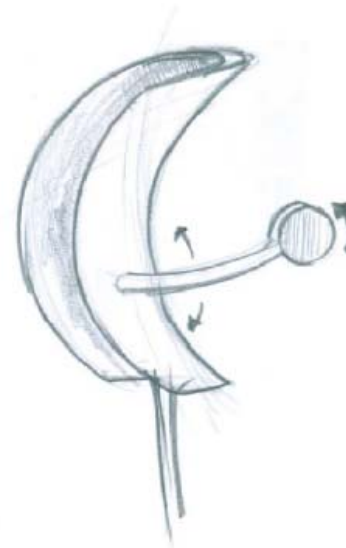
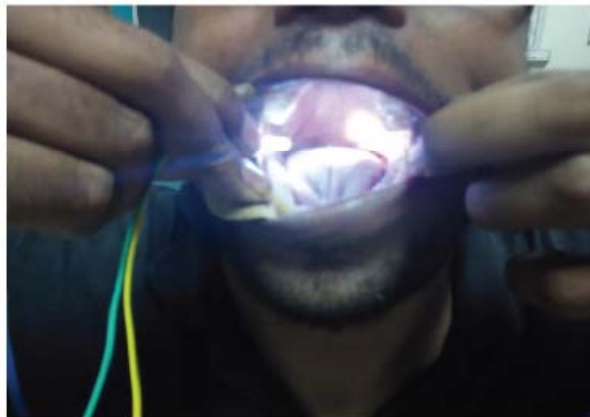
Testing with Dentist

UJALA

A retractor dental light considering rural scenario.

Final Design Brief:

To fix the light in a retractor (used by the doctor during oral surgery) which eradicates the problem of handling light by the dentist and discomfort of patient.



STUDENT SPACE DESIGN PROJECT (A COLLABORATIVE PROJECT WITH PUJ COLUMBIA FOR ME310 ACTIVITY AT STANFORD)

Design Problem: *"Design and create spaces that satisfy the needs of the students outside class."*

The project was to design "interactive experiences" for students and cater to their various needs of resting and leisure in the Academic Area of IIT Kanpur.



What happened before : Students had no place to sit. To talk, to discuss,

Students require space for lot of varied activities, and flexibility in the space for a comfortable and convenient design.

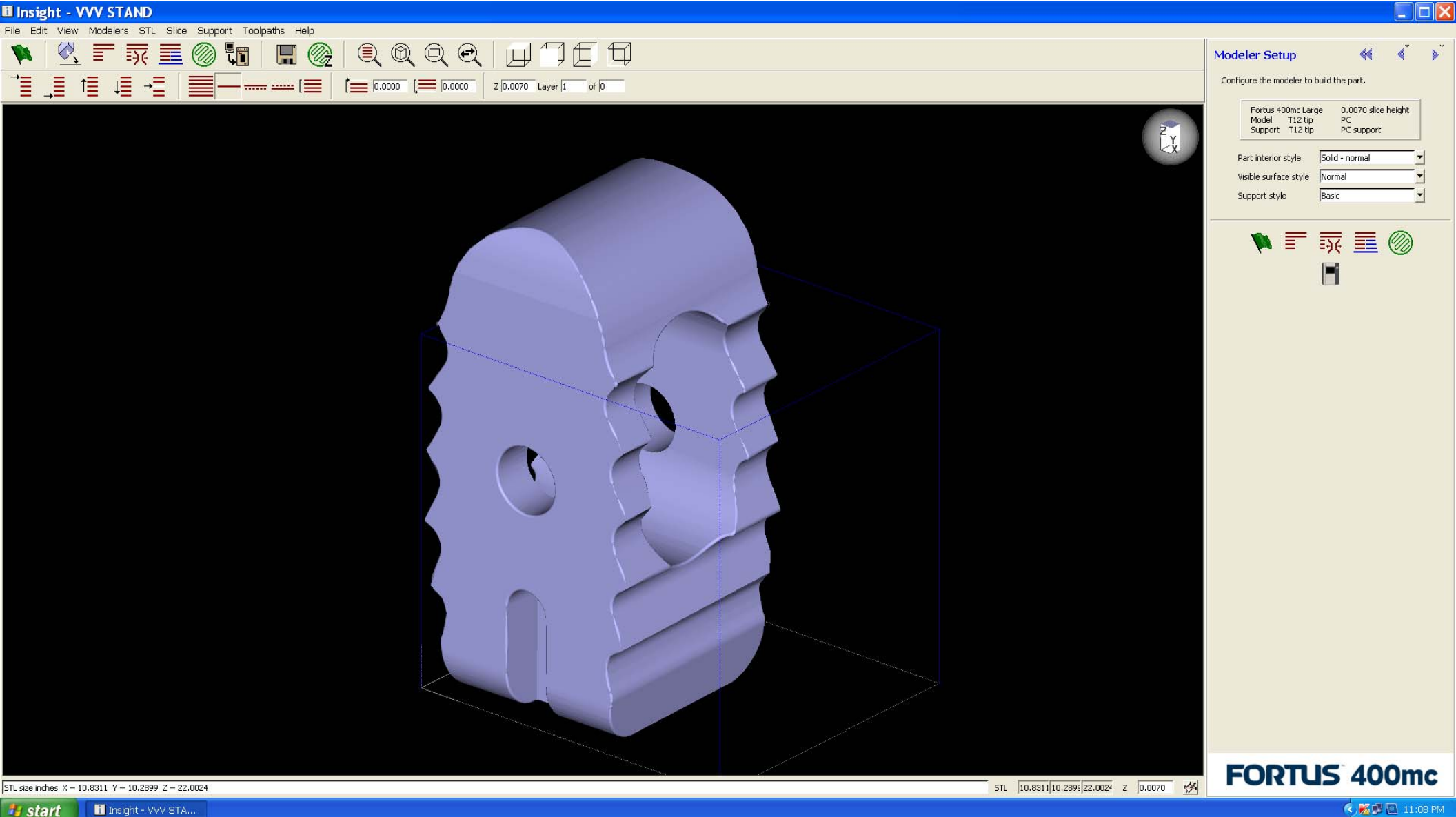


So a solution has been emerged in this project to cater to this space need for the students so that they can not only sit and relax but also do group studies, and other group activities.



DESIGN AND RAPID PROTOTYPING OF INVERTIBLE BODY FUSION DEVICE

(Support provided to Dr. Mohd. Kaif, Neurosurgeon Sahara Hospital)



Fabrication of Herringbone based Micromixer on PMMA sheet using CO₂ Laser micro machining Process

Sanjay Kumar, Vishal Kumar, Alok Kumar, Ashish Tiwari, Kartikeya Dixit, and Dr. Shantanu Bhattacharya**

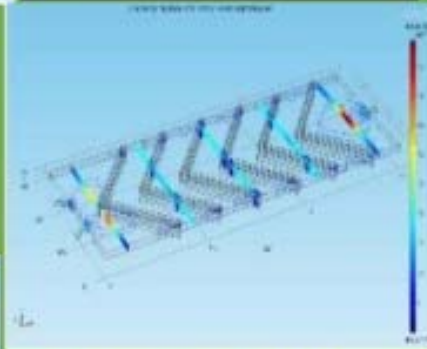
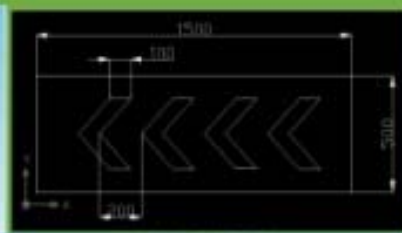
** Department of Mechanical Engineering, IIT Kanpur

Introduction: Micromixer is an important research area for various applications in sensing and diagnostics. In this study we fabricate herringbone structure on a PMMA sheet using CO₂ laser machine. the number of herringbone is simulated by COMSOL physics software.

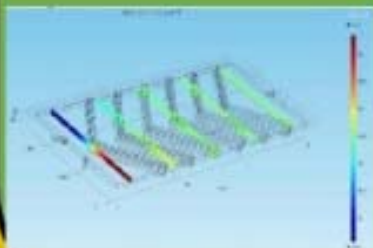
** Comsol simulation **



(i), (ii) schematic of herringbone micromixer



(iii) Slice view of velocity field



(iv) Slice view of concentration

** Fabrication of device **

Fabrication of the micromixer on PMMA material has been done using different combinations of power and cutting speed on a CO₂ Laser Machine.

(i) At Cutting power 35 W



(ii) At Cutting power 30 W



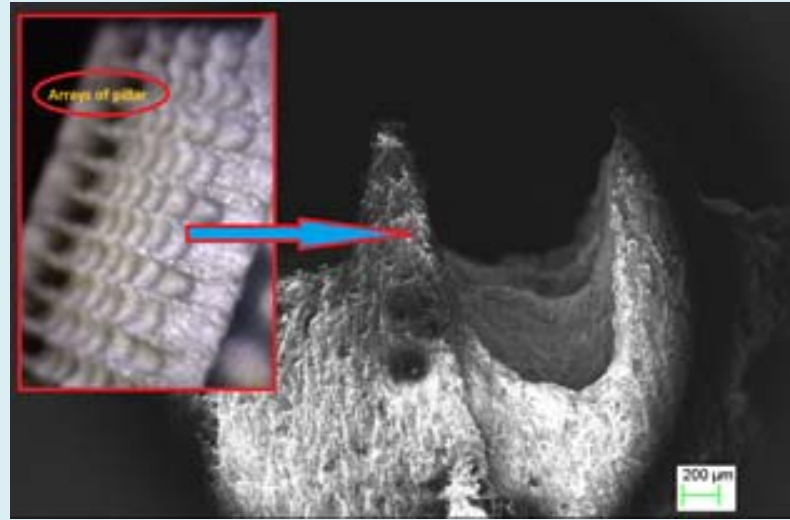
(iii) At Cutting power 25 W



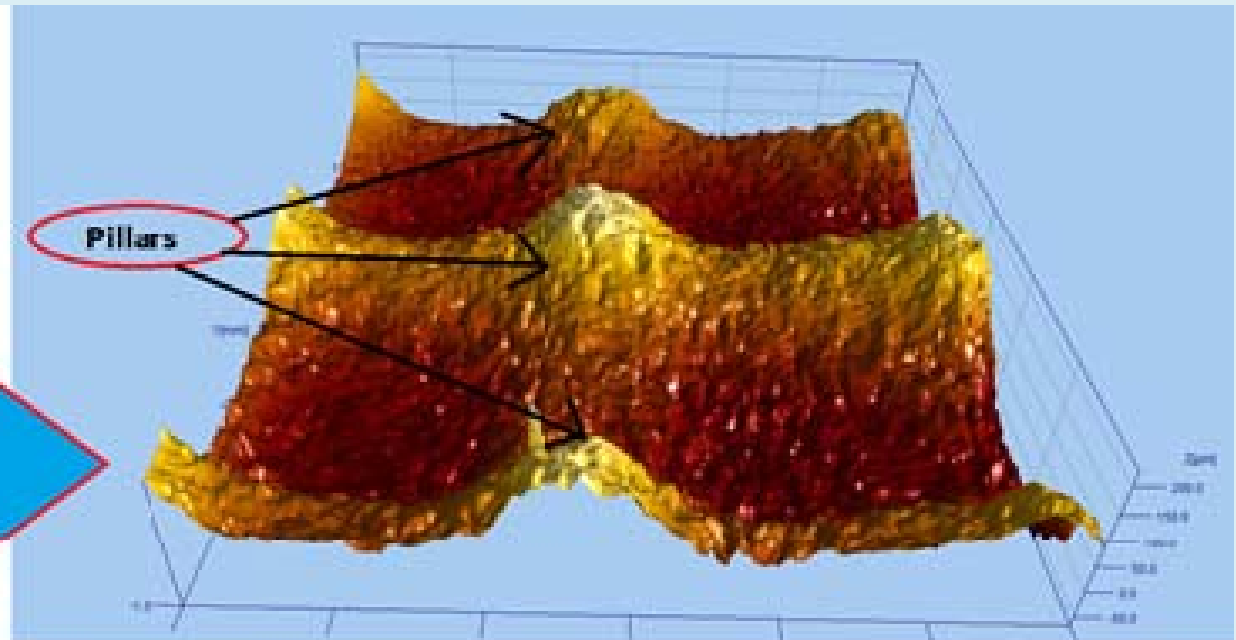
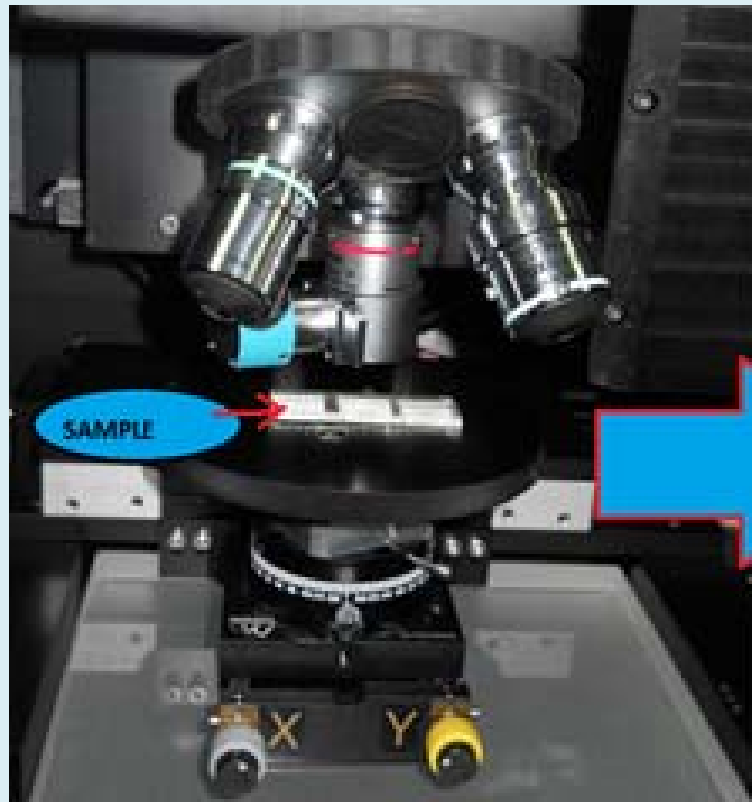
Conclusions: It is observed that with increase in cutting speed at 100% power the depth of micro-channel decreases. At the same time, the thermal distortion of geometry of herringbone pattern also decreases. Also, While decreasing the power at a constant cutting speed, the depth of cut decreases and finally a point comes where, no machining takes place.

PG innovation support/ Sponsored research work at 4i

By water jet
etching Micro
pillars fabricated
at 4i-lab



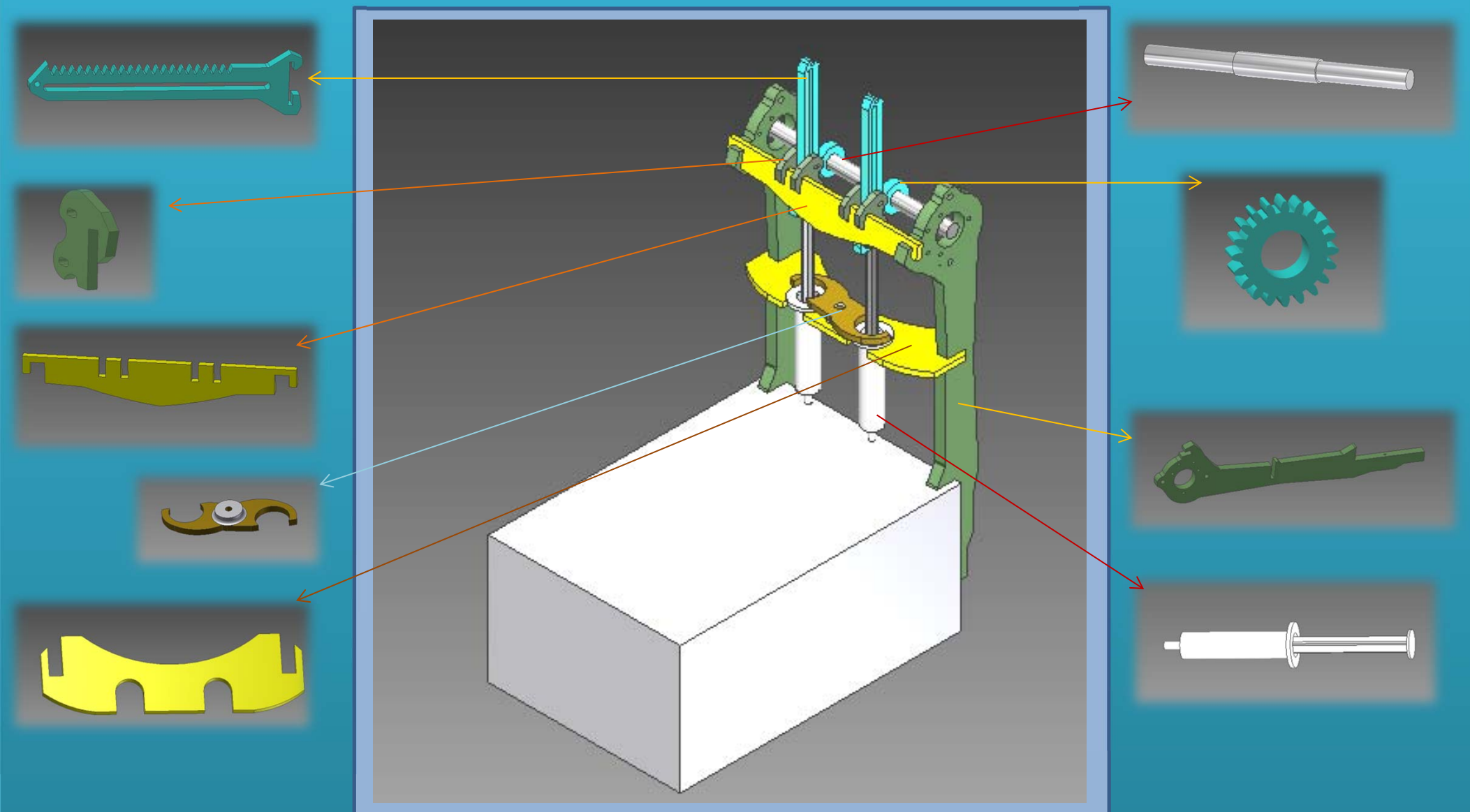
Research support to
Prof. S.K.
Chaudhuri's group



3-D Image of pillar

Fluid Injection System

4i designed the injection system for supporting a research problem of Prof. Siddharth Panda (Chemical Engineering Department)



Solar UV Water Filter being developed at 4i-lab (M. Des. Student Activity)

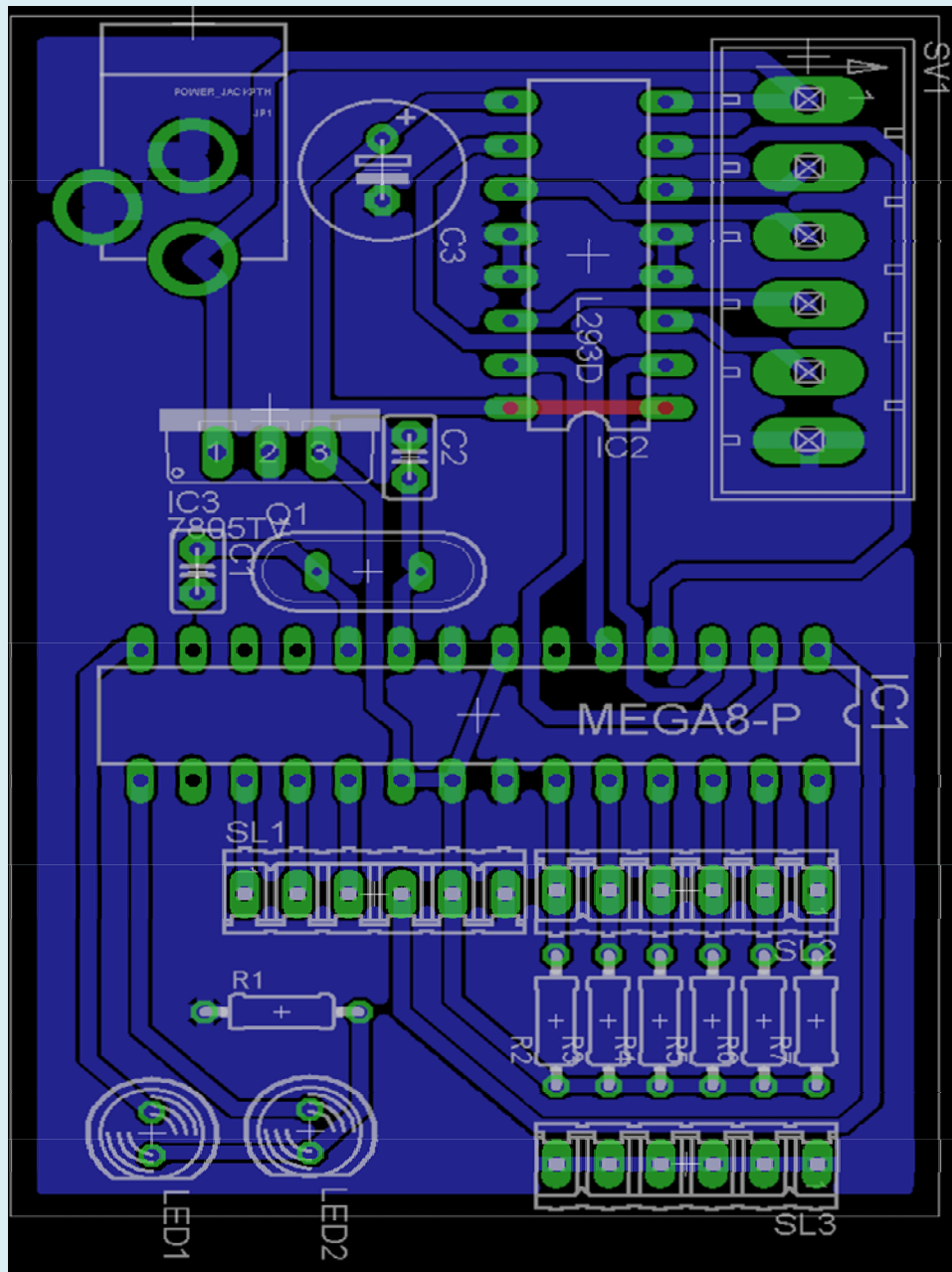


Image of PCB Layout for water filter



Image of Water Filter

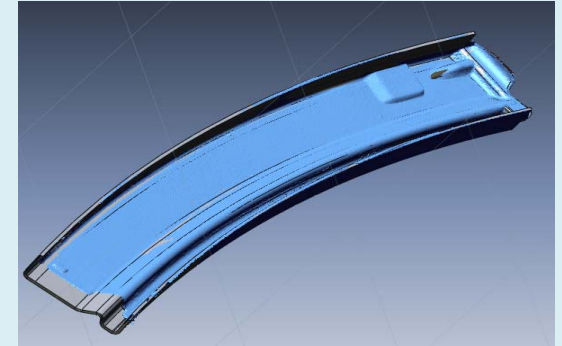
4I SUPPORT TO LOCAL INDUSTRIES



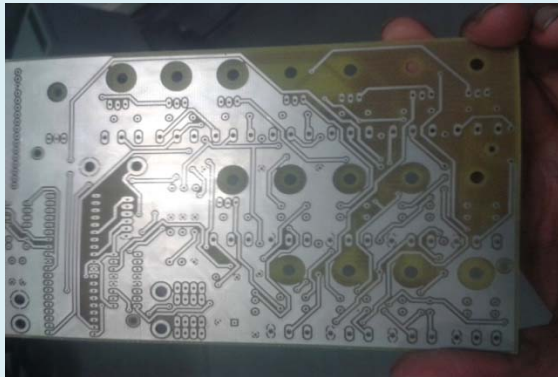
Mud-guard of Scooter front for LML industries



Die of water gun M/s Prime precision



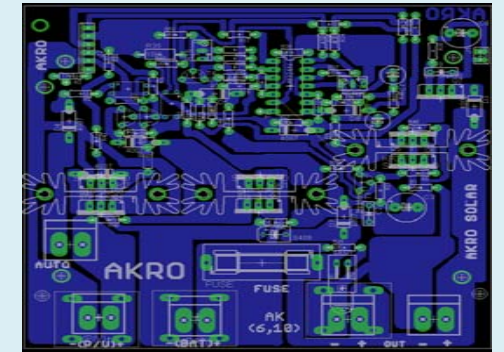
3-D Model of Gun Magazine (Gun Factory)



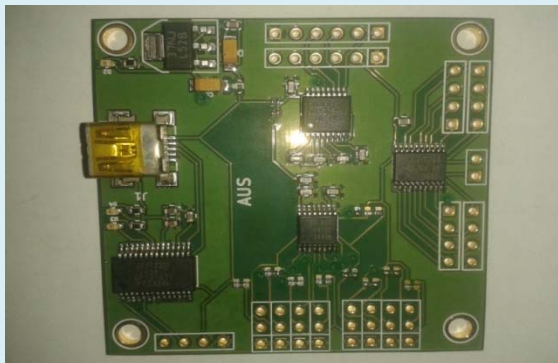
PCB made for Technosum Pvt. Ltd



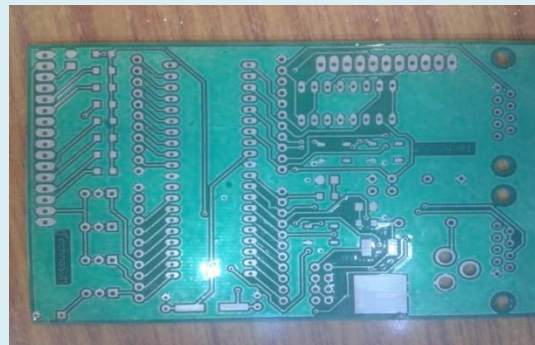
Die for Electronic LAMP (Netplast Pvt. Ltd.)



PCB of Solar Street Light (Akro solar and electronics pvt. Ltd.)



PCB made for Aarav Unmanned Systems Pvt. Ltd (SIDBI)



PCB made for Technosum Pvt. Ltd



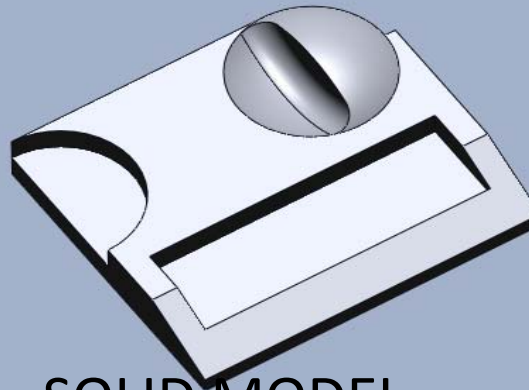
PCB made for E-spin nanotech pvt. Ltd.

- VLFM

4i support to development of a hands on training module for CIMS in VLFM (Curriculum development)



Scan Data

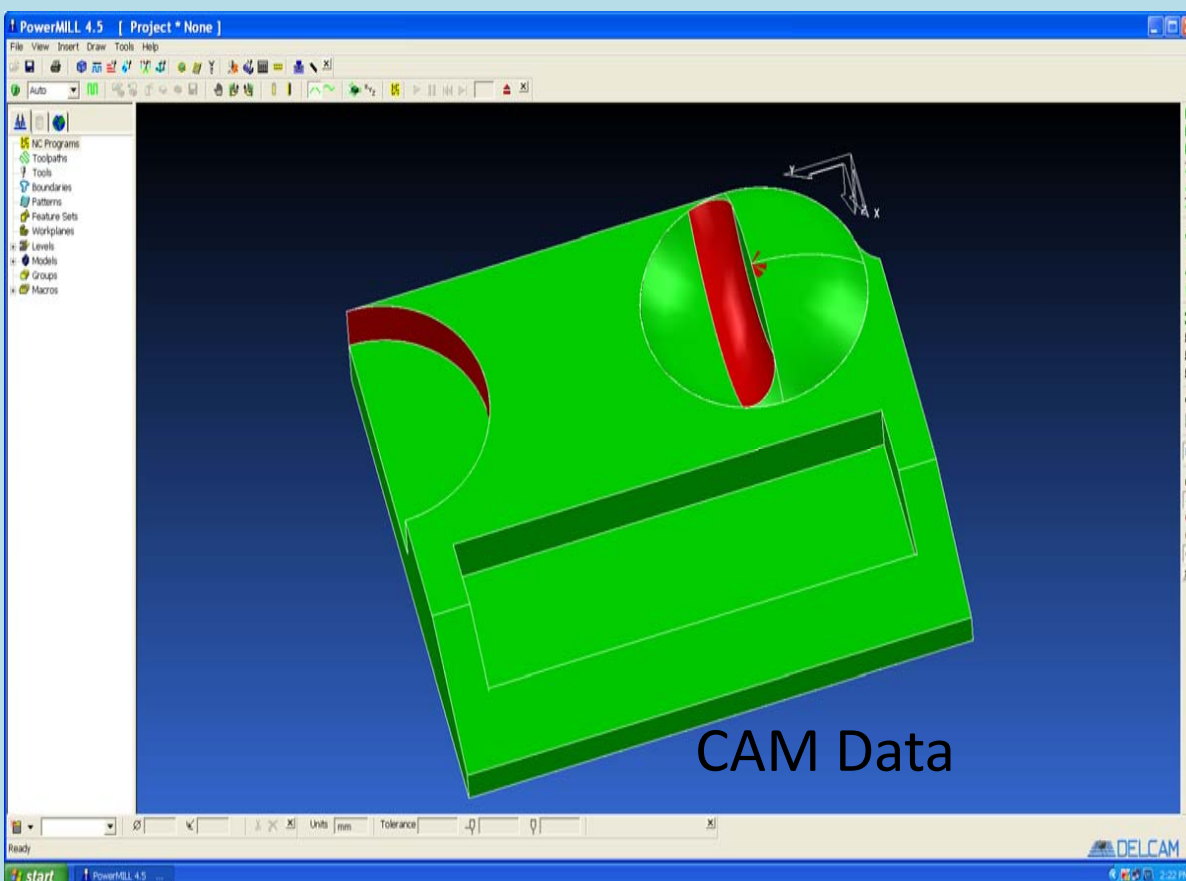


SOLID MODEL

Module 1:
CNC machining of engineering parts based reverse engineering approaches.

Module 2:
Building a Prototype of the part using 3-D printing.

Module 3:
PCB Fabrication Exercise.

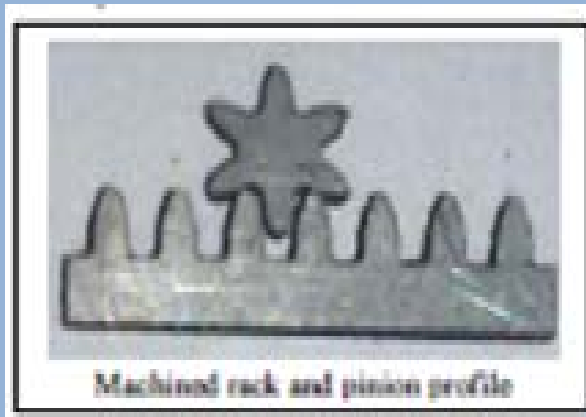


CAM Data

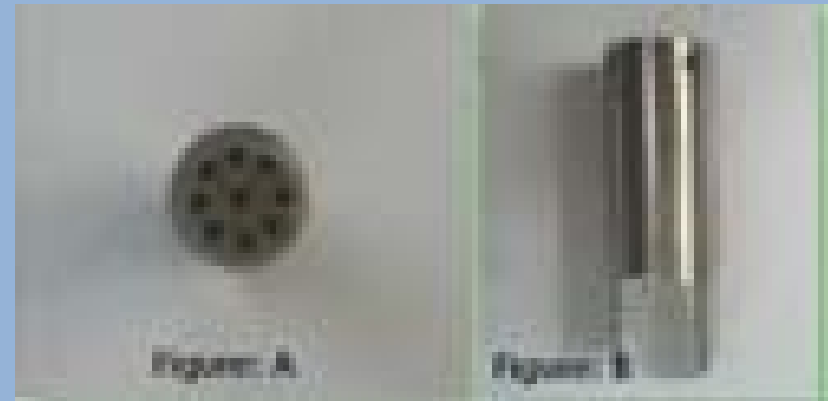


➤ Hands on training support for post graduate course
(curriculum development)

■ Course: ME 662, No of students in the course : 35 (five groups)



Miniaturized Rack and Pinion developed by CNC wire cut EDM



Miniaturized hole array drilled by Eze Drill on a drill bit



Miniaturized spur gear through water jet cutting



Miniaturized herringbone structures printed on acrylic sheet for micro-mixer application

➤ CNC Training Program with Reverse Engineering Approach for Industry.



- 10 Representatives from INFOTECH, Hyderabad

Target for next 2 years

- i. Internal Targets Setup
 - Man Power (augmentation needed)
 - Machine Utilization
 - Industrial Earning
15% increase per year
- ii. Offering high level training program to industries, small scale industries, other institutes to increase visibility of the 4i facility.
 - 2 per year
- iii. Research support to PG/ UG/ Industries
 - Develop a User Satisfaction Index through a feedback after the job order has been executed

Difficulties faced by 4i Lab

- Lack of skilled Manpower
- Space constraints (Space needed for MoT Brass project)
- Budget for Machine Maintenance

Institutional support needed

- 4i lab gets job order funding from industrial job. Institute should provide support for creating a consortium of local industries
- Skill development of personnel. (training programs and industry visit should be conducted)
- Infrastructure augmentation. (space identified for MoT brass project needs civil maintenance)
- Enhanced consumable budget. (needed to augment PCB facility)

THANK YOU