MAHATMA GANDHI MISSION DENTAL COLLEGE & HOSPITAL
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Plot No. 1 & 2 Sector-01 (Old 18 & 19), Kamothe, Navi Mumbai- 410209
E-Mail ID: mgmdch@mgmmumbai.ac.in

Title: Research training program on "Hands on training using FDM, SLA 3D printers and slicing software"

Target audience: Researchers and faculty

Date: 20th, 21st and 23rd September 2024

Time : 10 am to 3.30 pm

Venue : Vedas Department, Ground Floor, MGM Dental College & Hospital

REPORT

MGM Dental College & Hospital conducted a Hands-on training using FDM (Fused Deposition Modeling) and SLA (Stereolithography) 3D printers, as well as slicing software, involves learning the technical aspects of each 3D printing method, how to set up printers, and how to prepare models for printing.

PROGRAM OUTLINE

1. Introduction to 3D Printing Technologies

- **FDM (Fused Deposition Modeling)**:
    - o Overview: FDM uses thermoplastic filament, which is heated and extruded through a nozzle layer by layer to create a 3D object.
    - o Applications: Common in prototyping, functional parts, and educational purposes.
    - o Materials: PLA, ABS, PETG, and other filaments.
- **SLA (Stereolithography)**:
    - o Overview: SLA uses a laser or projector to cure liquid resin layer by layer to form a 3D object.
    - o Applications: Ideal for high-precision parts, jewelry, dental models, and figurines.
    - o Materials: Various resins such as standard, flexible, and castable.

2. Basic Printer Setup

- **FDM Printer**:
    - o Loading filament into the printer.
    - o Setting the print bed (leveling, cleaning).
    - o Understanding nozzle temperature, print speed, and cooling settings.
- **SLA Printer**:
    - o Pouring resin into the vat.
    - o Calibrating the build plate.
    - o Setting exposure time and layer height.

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3. **Slicing Software Overview**

- **What is slicing software?**
    - Slicing software converts a 3D model (typically in STL or OBJ format) into instructions (G-code) for the 3D printer.
    - Popular slicing software includes **Cura**, **PrusaSlicer** (FDM), and **Chitubox**, **Lychee** (SLA).
- **Key Features**:
    - Adjusting print orientation to optimize strength and reduce material use.
    - Setting layer height, infill density, and print speed.
    - Support structures: Creating supports for overhangs and delicate parts.
    - Understanding print preview: Checking for errors, ensuring correct layer paths, and estimating print time.

4. FDM Printing Workflow

- **Pre-printing**:
    - Open the 3D model in slicing software.
    - Choose printer settings (layer height, infill, supports).
    - Generate G-code and save to SD card or send directly to the printer.
- **Printing**:
    - Monitor the printing process for issues like warping or nozzle clogging.
    - Post-processing (removing supports, sanding, painting).

5. SLA Printing Workflow

- **Pre-printing**:
    - Import the model into slicing software.
    - Choose resin-specific settings (exposure time, layer height, supports).
    - Generate the file and send it to the printer.
- **Printing**:
    - Ensure proper venting and curing conditions.
    - Monitor the print for layer adhesion or resin issues.
- **Post-processing**:
    - Wash the print in isopropyl alcohol (IPA) to remove excess resin.
    - Cure the print under UV light (post-curing).
    - Remove supports carefully and finish with sanding or painting.

6. Troubleshooting

- **FDM Printer Issues**:
    - Warping, under-extrusion, over-extrusion, stringing.

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- o Bed adhesion issues.
- o Clogged or misaligned nozzle.
- **SLA Printer Issues**:
  - o Layer adhesion problems, insufficient resin curing, print shifting.
  - o Problems with supports or print detachment.
  - o Over-curing and resin curing inconsistencies.

7. Safety Considerations

- **FDM Printers**: Handling hot surfaces, using proper ventilation for fumes, and ensuring safe filament handling.
- **SLA Printers**: Handling resins carefully, wearing gloves and goggles, working in well-ventilated areas, and disposing of resin waste safely.

8. Applications and Advanced Topics

- **FDM**: Customizable part designs, multi-material printing, and dual-extrusion setups.
- **SLA**: Resin types (clear, flexible, castable, etc.), fine-detail printing, and medical/dental applications.
- **Hybrid Techniques**: Combining FDM and SLA prints for more functional prototypes.

9. Post-Training Practice

- **Hands-on Practice**:
  - o Participants can practice loading the filament, adjusting settings, and starting prints on both FDM and SLA printers.
  - o Create models using slicing software and experiment with different print settings to see real-time results.
- **Discussion of Challenges**: Share and discuss challenges encountered, such as layer adhesion problems or support structure issues, with a trainer guiding solutions.

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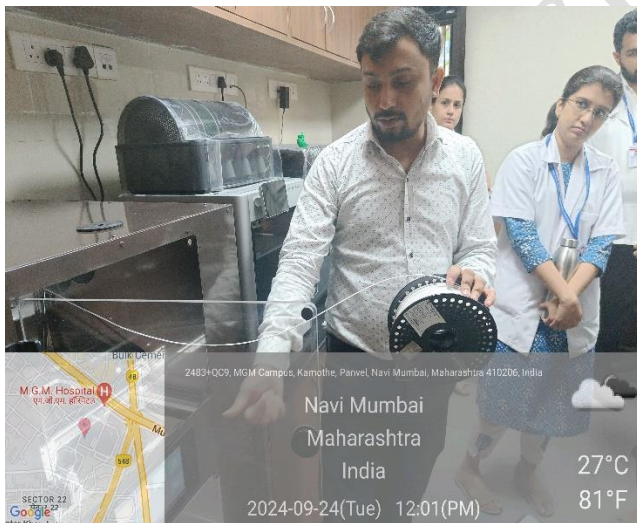Plot No. 1 & 2 Sector-01 (Old 18 & 19), Kamothe, Navi Mumbai- 410209
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PHOTOGRAPHS

DETAILED EXPLANATION OF 3D PRINTING TECHNOLOGY BY EXPERT

DEMONSTRATION OF FDM AND SLA3D PRINTER

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