

IAS0031 Modeling and Identification

Research on Scanning & Printing in 3D

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Outline

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Introduction

- Background and current education:
 - B.Sc. Electrical & Electronics and Mechatronics Engineering
 - M.Sc. Mechatronics Engineering
- Topic of the project
 - 3D scanning and printing of selected model with proper hardware and software tools
- Motivation
 - To gain more knowledge in rapidly developing fields of 3D technology by conducting a research on applications of 3D scanning and 3D printing.
 - Obtaining more hands-on experience with the usage of 3D hardware and software tools.



Project Goals and Steps

- **Decide** the feasible object to work on
- **Research** on necessary tools
- **Contact** authorized personnel
- **Select** necessary hardware and software
- **Scan** the object with 3D scanners
- **Show** the scan results on 3D display
- **Adjust** the models according to constraints
- **Print** the finished models with 3D printer



Methodology

- **Literature Review:** Current situation of 3D printing and 3D scanning technologies in industry
- **Chosen Model:** Plastic Duck Toy
- **Equipment:** Several hardware and software tools available in the university and licensed to be used on student projects





Tools

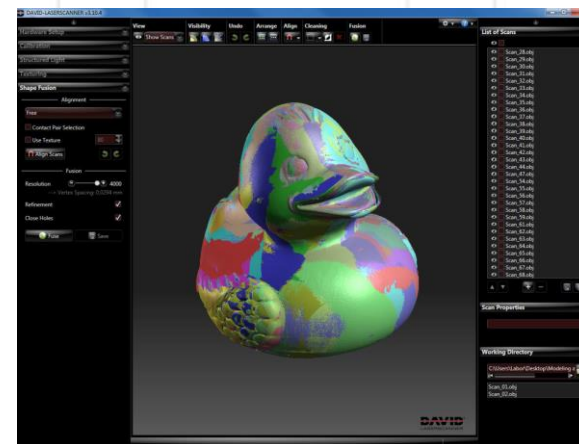
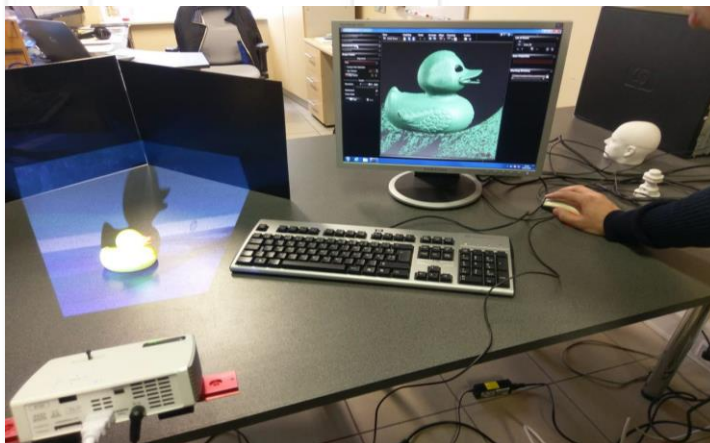
- 3D Scanners
 - HP 3D Structured – Light Scanner Pro S3
 - ATOS II by GOM
 - Fuel3D
 - Nikon MMDx100 + ABB IRB1600-10 Robot System
- 3D Software
 - Netfabb (Autodesk)
 - Meshmixer (Autodesk)
 - Magics (Materialise)
 - Cura (Ultimaker)
- 3D Printers
 - IdeaWerk WT200
 - EOS Formiga P100
 - Realizer SLM50
 - Ultimaker 2



Structured-Light Scanning

- HP 3D Structured – Light Scanner Pro S3
- Light Source
- 2D Camera

- Time: 4 hours
- Export: OBJ
- Required additional software

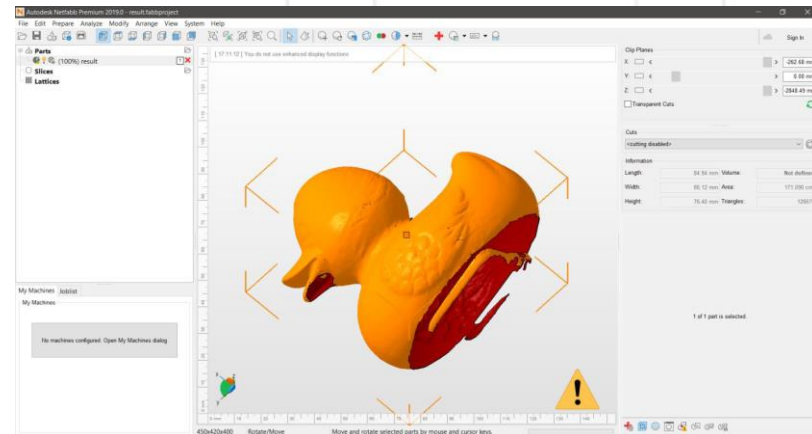
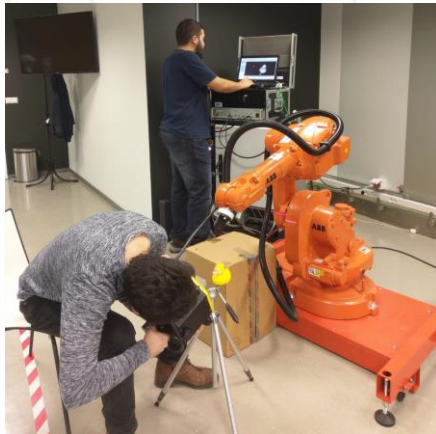




Laser Scanning

- Nikon MMDx100 Scanner
- K-CMM - Portable Optical CMM System
- ABB IRB1600-10 Robotic arm

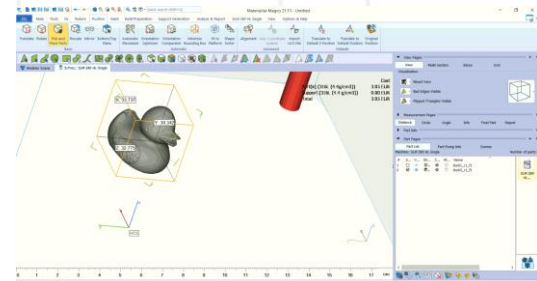
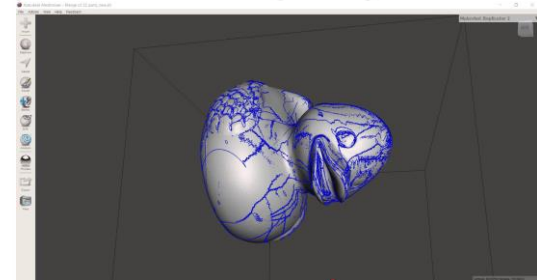
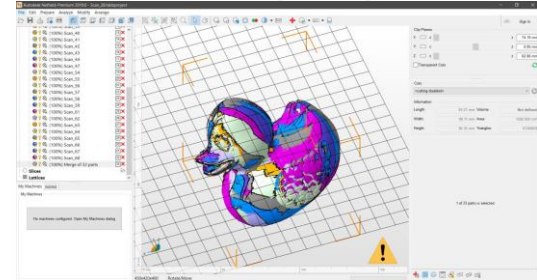
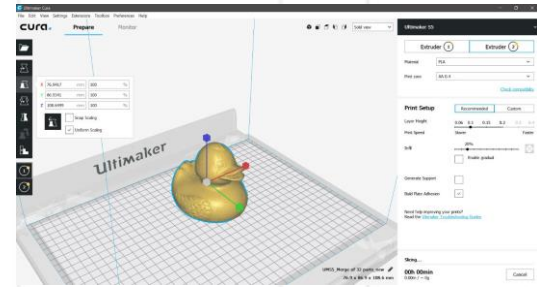
- Time: 4 hours
- Export: STL
- Required additional software

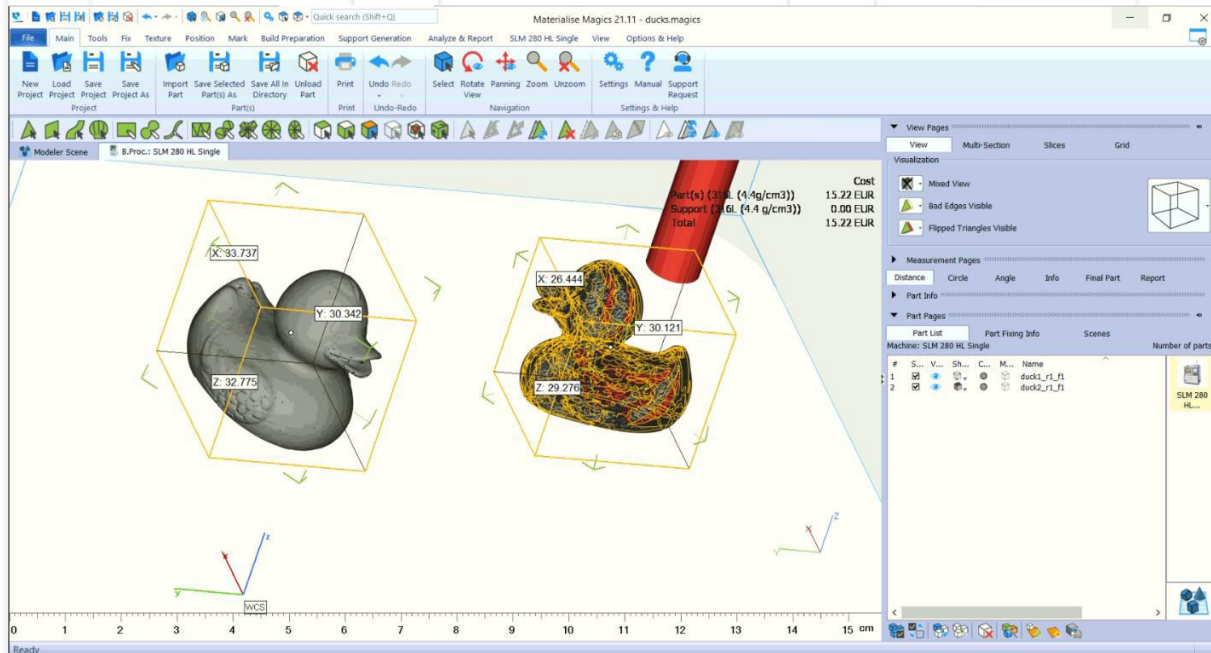
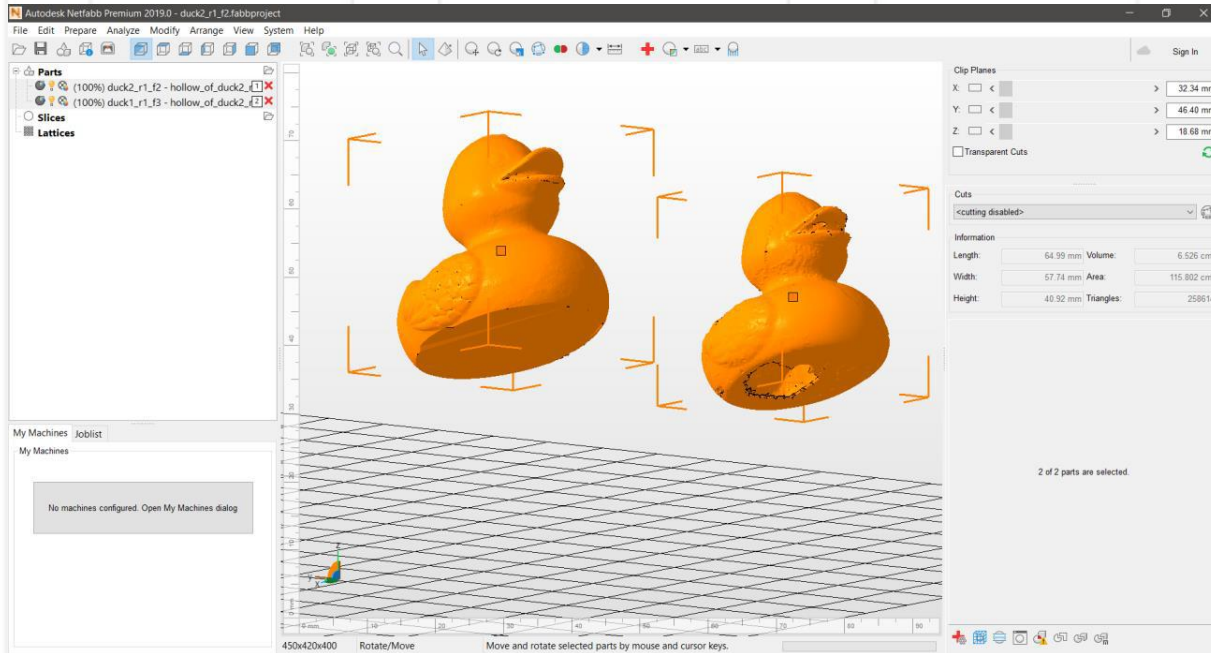




Software

- David (HP)
 - Light-Structured Scanning
- CMM software (Nikon)
 - Laser Scanning
- ABB Controller
 - ABB robotic arm control
- Netfabb (Autodesk)
 - Combining the scans
- Meshmixer (Autodesk)
 - Solidifying the models
- Magics (Materialise)
 - Adjustments for printing
- Cura (Ultimaker)
 - Printing time estimation
- CraftCloud
 - Prints cost estimation (180 €)







Plastic SLS 3D Printer

- EOS Formiga P100
- Material: Nylon PA11 powder
- Time: 24 hours
- Wall thickness: 0.1 mm
- Cost: 30 €
- No support material
- Fragile end product

Light-Structured Scan



Laser Scan





Metal SLM 3D Printer

- Realizer SLM50
- Material: Aluminum Silicon Magnesium Alloy powder
- Wall thickness: 0.07 mm
- Cost: 150 €
- Support material could not be removed completely
- Strong end product

Light-Structured Scan



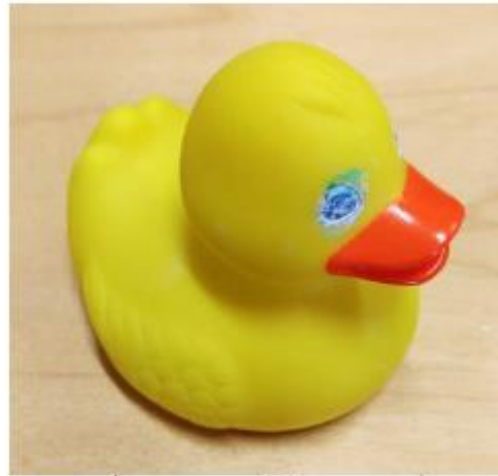
Laser Scan





Results

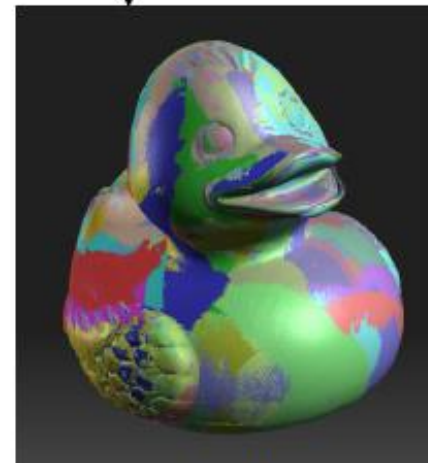
- Broad research on 3D scanning and printing technologies
- Object successfully scanned with two different scanning technologies
- 3D models of the object were created and adjusted according to the constraints
- Several copies are printed by using two different printing technologies to show how different scans will result in them
- Different error rates are observed from different scanners and printers



Model



Laser scan



Structured-light scan



SLM print



SLS print



SLM print



SLS print



Major Challenges and Successes

- Too many sources
 - An overall literature review was prepared
- Model selection
 - A challenging model was chosen
- Fusing the scans
 - Several software tools was used
- Time and equipment limitations
 - Necessary planning was made before the usage
- Cost of equipment and process
 - Work was adjusted for optimum values
- Printing schedule
 - More than one project were printed together



Conclusion

- A comprehensive research on 3D technologies was completed with the focus of 3D scanning and 3D printing
- Several software and hardware tools were successfully studied both in theoretical and practical ways
- It is possible to have higher quality results with more time and budget in computational and materials aspects





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