IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 11, May 2025
Impact Factor: 7.67

Development of a Secure and Scalable E-Commerce Marketplace for 3D Printable Designs

Dr. Nilesh S. Navagale, Siddhesh Chandole, Mukesh Kumavat, Shekhar Gaikwad
Department of Mechanical Engineering
JSPM's Rajarshi Shahu College of Engineering, Pune, India

Abstract: *With the rapid adoption of 3D printing technologies, the demand for accessible and high-quality digital design files is growing exponentially. This paper presents the development of a live e-commerce website that hosts 3D printable designs made in SolidWorks and CATIA. Our platform enables clients to browse, preview, and securely download files for immediate 3D printing. The system addresses key challenges including intellectual property protection, file compatibility, printability validation, and user experience design. We implemented a full-stack web solution, developed and tested in-house, that combines technical reliability with a user-friendly interface. This paper explores the architecture, methodologies, and practical implementation of the platform and discusses future enhancements like print-on-demand services and blockchain-based licensing..*

Keywords: 3D Printing, E-commerce Platform, SolidWorks, CATIA, Additive Manufacturing, Digital File Sharing

I. INTRODUCTION

Additive manufacturing has redefined production in numerous industries by offering flexibility, customization, and cost-efficiency. However, accessing quality 3D printable files remains a challenge, especially for hobbyists, engineers, and small-scale manufacturers. Our project addresses this gap by developing a functional web-based platform that hosts curated 3D design files created in professional software like SolidWorks and CATIA. Users can easily browse categories, preview models, and download files compatible with a wide range of 3D printers. This paper details the process of building this secure, scalable platform, highlighting the technical and practical decisions behind our design and implementation.

II. PROBLEM STATEMENT

- Despite the growth of 3D printing, designers and end-users face numerous issues:
- No centralized platform focused on verified, high-quality, and ready-to-print 3D designs.
- Inadequate protection for intellectual property rights.
- Lack of monetization options for creators.
- Compatibility issues between uploaded files and user printers.
- Non-user-friendly interfaces on existing platforms.
- Our solution is a purpose-built platform that directly addresses these concerns.

III. OBJECTIVES

- To build a functional e-commerce website that allows secure browsing and downloading of 3D printable models.
- To support SolidWorks and CATIA-based file uploads, with STL/OBJ export.
- To ensure printability through model checks and metadata (scale, units, material suggestion).
- To provide user registration, login, and secure payment/download systems.
- To implement search, filters, categories, and model previews.

DOI: 10.48175/IJARSCT-27299

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 11, May 2025
Impact Factor: 7.67

- To create admin controls for content moderation and analytics.
- To foster a growing community around quality design sharing.

IV. METHODOLOGY

Our methodology was divided into seven key stages:

Requirement Gathering: We interviewed students, hobbyists, and local 3D printing providers to understand user needs and design pain points.

Design Tools Used: SolidWorks and CATIA were used to develop more than 20 complex mechanical and utility models.

System Design:

Frontend: Built using HTML5, CSS3, JavaScript, and Bootstrap.

Backend: PHP and MySQL were used for server-side logic and database management.

Storage: Design files are securely hosted on the server with encrypted access.

Functionality Developed:

Secure user login/registration

Model upload interface for admins

Category filters (Mechanical, Tools, Artistic, Educational)

3D model previews (static image + model metadata)

Download button with DRM watermarking option

Testing: Functional testing on Chrome, Firefox, and mobile browsers. We ensured STL integrity and download protection.

Deployment: The website was hosted on a Linux-based server with Apache, using HTTPS for security.

User Feedback: We collected beta user feedback to improve navigation and model discovery.

V. WEBSITE FEATURES AND CAD MODEL SHOWCASE

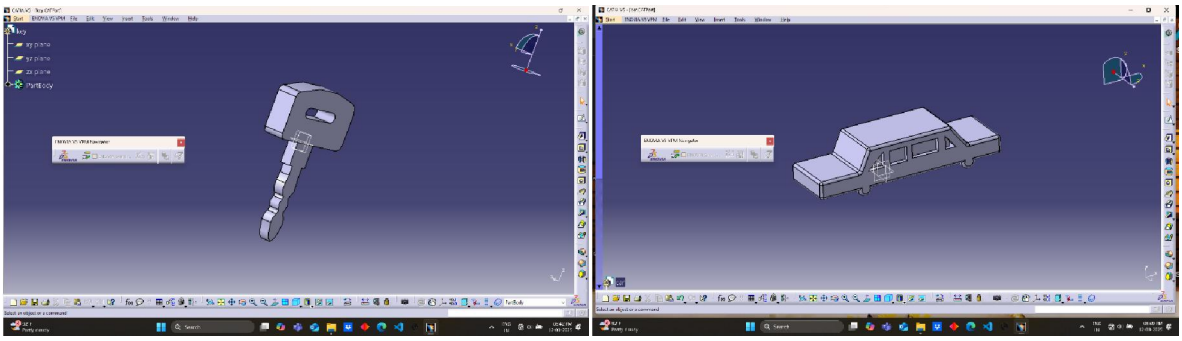
CAD Design Examples:

- Mechanical linkage assembly
- Tool holder
- Gear mechanisms
- Parametric fan blade
- Customized keychains
- Snap-fit enclosures

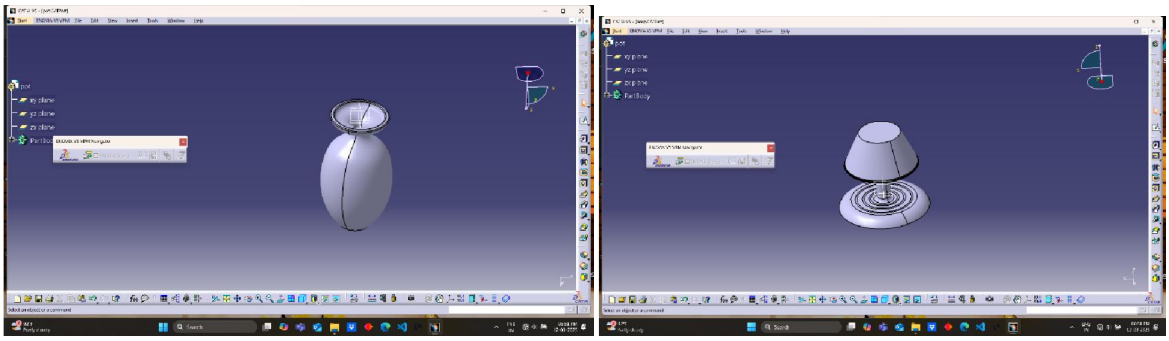
Website Features:

- Clean, responsive UI optimized for both desktop and mobile.
- Model detail page includes size, format, software used, and material suggestion.
- Admin dashboard for managing designs, users, and reports.
- Secure download links with limited time access.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 11, May 2025
Impact Factor: 7.67



Key Car



Flower Pot Table Lamp

VI. LITERATURE REVIEW

3D model sharing platforms like Thingiverse and MyMiniFactory lack comprehensive IP protection and monetization. Studies highlight:

- The need for watermarking and license tagging (Liang & Yu, 2020)
- Impact of search and recommendation systems (Ricci et al., 2011)
- Benefits of user-generated content ecosystems (Preece, 2009)
- Our work extends these by integrating secure downloads, DRM, and professional file standards.

VII. FUTURE SCOPE

We aim to implement:

- On-demand printing services via third-party partners.
- Support for interactive 3D previews using Three.js or similar libraries.
- Blockchain licensing for creator verification and smart contract royalty splits.
- Mobile application for design browsing and downloads.
- Language localization and currency conversion for global expansion.
- Subscription plans for premium models and exclusive creator tools.

VIII. CONCLUSION

This project demonstrates the feasibility and utility of a secure, scalable, and user-focused marketplace for 3D printable designs. By blending engineering design tools with web development, we created a platform that benefits both creators

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 11, May 2025
Impact Factor: 7.67

and end-users. The success of this prototype suggests great potential for expansion and community-driven growth in the 3D printing industry.

REFERENCES

[1] Gebler, M., Schoot Uiterkamp, A. J., & Visser, C. (2014). "A Global Sustainability Perspective on 3D Printing Technologies." *Energy Policy*, 74, 158-167.

[2] Desai, D. R., & Magliocca, G. N. (2014). "Patents, Meet Napster: 3D Printing and the Digitization of Things." *Georgetown Law Journal*, 102, 1691-1720.

[3] Rayna, T., & Striukova, L. (2016). "From Rapid Prototyping to Home Fabrication." *Technological Forecasting and Social Change*, 102, 214-224.

[4] Srai, J. S., et al. (2016). "Distributed Manufacturing." *International Journal of Production Research*, 54(23), 6917-6935.

[5] Nielsen, J. (2016). *Usability Engineering*. Morgan Kaufmann.