

Creation of product designs and manufacturing procedures for combining 3D-printing and RFID technologies

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Executive Summary

The Industrial Manufacturing and Systems Engineering Department at UTA is implementing an NFC keychain manufacturing process to use for the professors, research groups, and department-related student organizations. Further experimentation into the project led to NFC nametags for Professors and students to wear for networking events.

Background

Project

This project focuses on developing a system for IMSE Professors and approved student groups to print and program NFC enabled keychains and nametags to serve as customized business cards for use at conferences and networking events.

Why NFC tags are important:

- Improve efficiency and productivity
- Enhance product quality and consistency
- Improves workflow and overall system performance

Key Features

- Cost-efficient custom manufactured keychains
- Low lead time as they are made in-house
- Infinitely reprogrammable, multi-use capabilities

Target Users:

- IMSE professors and staff
- IMSE student researchers
- IMSE student chapter

References

Dr. Bonnie Boardman
MAE 1351, IE 4325, IE 4339, IE 4303

Methodology

Our team utilized design experimentation to create a custom design for the keychains to determine the best size and resolution for the format of the keychain, as well as the best location for the NFC sticker that is printed within the keychain

Additionally, the team:

- Assembled and set up the 3D printer in the IE Capstone Lab, ensuring proper calibration, material loading, and system configuration to achieve reliable and repeatable printing results.
- Designed keychains using online CAD modeling software, allowing the team to rapidly prototype different shapes, dimensions, and design features while incorporating the university branding and accommodating the embedded NFC tag.
- Used Bambu Studio to prepare and assign print settings
- Manufactured the final prototypes through 3D printing, producing multiple iterations that were tested for durability, visual quality, and NFC performance.



Fig. 1 Printer in use



Fig. 2 Failed Prototype

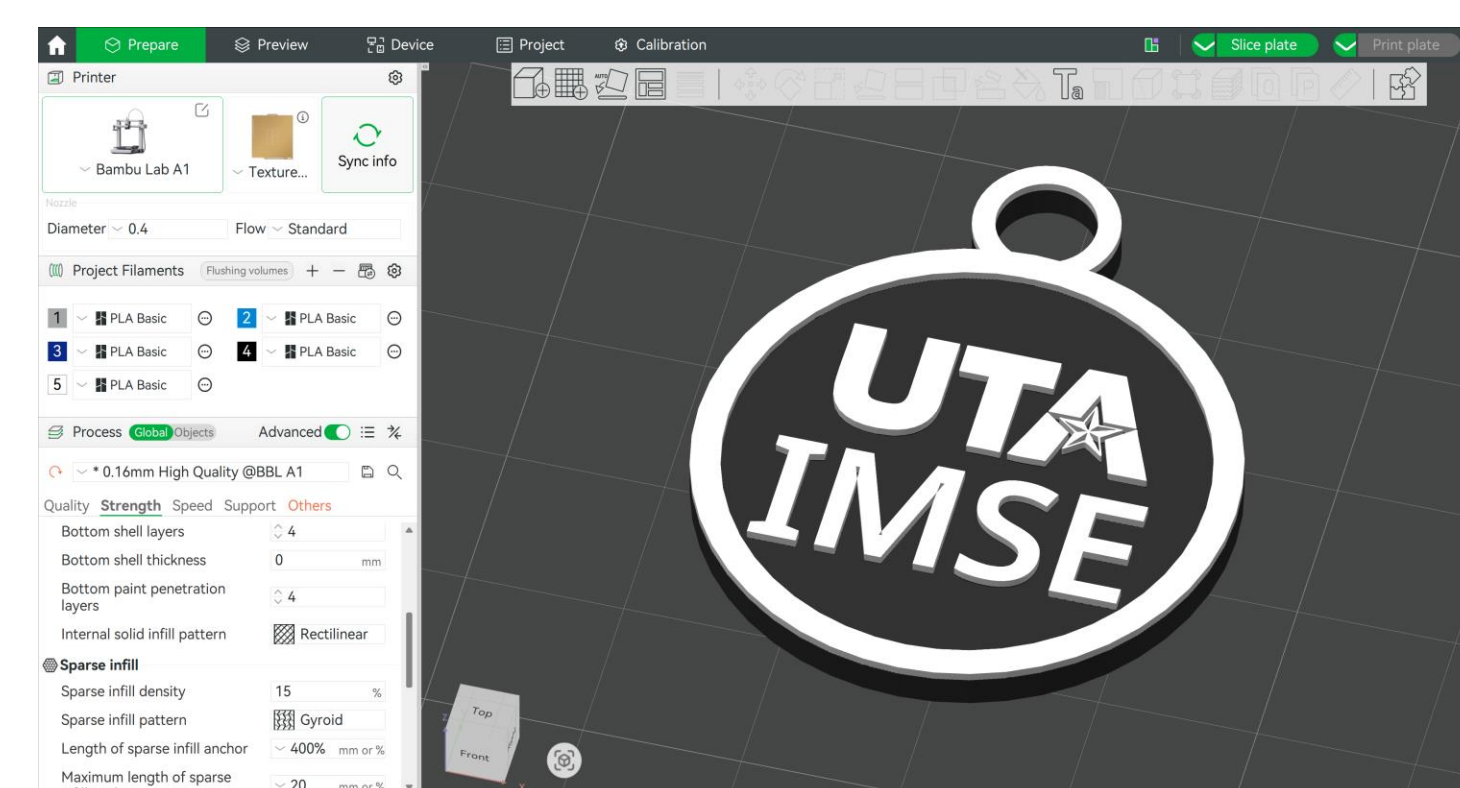


Fig. 3 BambuLab Software

Results

Three prototypes were developed and tested to evaluate both functionality and design quality.

- **Prototype 1:** Successfully demonstrated RFID functionality. However, the design was not visually representative of the university, which led to further improvements.
- **Prototype 2:** Incorporated the University of Texas at Arlington logo, improving aesthetics and maintaining functionality. The RFID system worked in approximately **70% of attempts**, similar to Prototype 1.
- **Prototype 3:** Focused on improving RFID performance by placing the tag closer to the bottom surface to increase scanning range. While this approach aimed to enhance usability, it negatively affected the overall appearance of the keychain and did not significantly improve reliability. Overall, the prototypes validated the feasibility of combining 3D printing with RFID technology, but also highlighted the need for improved consistency and design balance.

Conclusion

This project successfully demonstrated the feasibility of integrating 3D printing and RFID technology to create functional and customizable keychains. Through multiple design iterations, the team identified key challenges related to reliability and design optimization, while validating the potential of this solution as a practical tool for networking and information sharing.

With further improvements, this system can become a scalable resource for the University of Texas at Arlington, supporting academic, professional, and student engagement activities.



Fig. 4 Final versions

Control and Future Work

In the final stages of the project, the student team will begin writing the documentation for using the Bambu Lab printer within the department, so that any Professor could use the printer to manufacture NFC tags when needed. Furthermore, this project aims to expand its implementation across the University of Texas at Arlington, enabling other departments to adopt RFID-enabled keychains. Future work will focus on:

- Improve RFID reliability to achieve consistent scanning performance
- Standardize the manufacturing and programming process for ease of use
- Implement its use in conferences, classroom activities, and student events
- Encourage collaboration with different departments at the University of Texas at Arlington to adapt and utilize this technology based on their academic and outreach needs