Secure and Remote 3D Printing Design Document



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1. Introduction

1.1 Background

We have been tasked to design and develop a web application to schedule, approve/decline, and monitor the process of an Ender 3 (3D) printer. We are using Octoprint to handle the non GUI components of the application such as keeping track of how long the print will need, how far the project is, etc. This aspect was important to include because it keeps the queue of projects running while also allowing the Admin to know when to clean off the printer so the next job can start. It also helps the users to know when their 3D project has been completed and they can pick it up. We will also work on making the 3D printing experience more secure to ensure that the printing process is not interrupted or altered by an attacker.

1.2 Purpose

The purpose of this project is to ensure that users are getting the exact model that they uploaded to the web application. This is crucial because an attack on a big project could lead to massive setbacks or an increase in production of proprietary models that could be stolen and sold. The project also allows for remote uploads, tracking, and modifying thus allowing a more accessible web application.

1.3 Goals

The goal of this project is to have a fully functional web application that allows users to monitor, upload, and modify 3D printing projects as well as ensuring the safety of those projects. There are issues with the current 3D printer's firmware which allows attackers to modify or inject G code into an ongoing project and we aim to fix that. Reducing the ability for attackers to gain access to the 3D printer will reduce the amount of wasted materials and will improve the customer's experience.

2. Diagrams

2.1 Architectural design



2.2 Application ER Diagram



2.3 ER Diagram Components

- \succ Web application:
 - Houses the entire database to help store projects, user authentication, and restricted web pages.

- ➤ Users:
 - Can login to access more pages on the web application to get information on their currently uploaded projects or upload a new project.
 - Not logging in restricts the user to view low risk web pages (more information below)
- \succ Permission based pages:
 - Only allowed users can view these pages to restrict the amount of user data that could be leaked. Some pages reveal more information depending on the permissions of the user.
 - An example of this is the queue page which displays the entirety of the queue for administrators while only displaying user-specific information for those who have pending prints.
- ➤ Non-permission based pages:
 - These are web pages that unverified users are allowed to access. These are crucial to approve new users and allow them to gain more information about what the web application is about.
 - These include the home, login, and registration pages.

Entity Table:	Table Attributes:
Web Application	web_app(primary key: url, framework, certifications)
Users	users(primary key: username, password, multi-valued: projects, admin capabilities)
Permission Based Pages	perm_pages(primary key: admin, queue, upload)
Non-Permission Based Pages	non_perm_pages(primary key: home, login, register)

2.4 ER Diagram Data Tables

3. Web Page Mockup

3.1 Home Page



3.2 Login Page

FLORIDA TECH	Login Page		
Upload Model	Queue Viewer	Register	Login
Username		Password	
Forgot Password? (Link)			
Login			

3.3 Registration Page

FLORIDA TECH	Registration Page		
Upload Model	Queue Viewer	Register	Login
First Name		Last Name	e
Username		Email	
	Password		
	Subi	mit	

3.4 Upload Page

FLORIDA TECH	Upload Page		
Upload Model	Queue Viewer	Register	Login
Title			
Description)	
Upload Sele	ction		Submit

3.5 Queue View

FLORIDA TECH	Queue Page		
Upload Model	Queue Viewer	Register	Login
Username	Email	Upload Name	Queue Position
JaneDoe	janedoe@gmail.com	JanesFile.gcode	1
JoeShcmo	joesh@gmail.com	JoesSecretPrint.gcode	2
DrOc	droc@gmail.com	drocprint.gcode	11