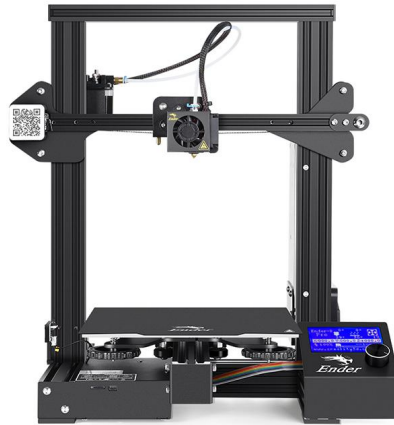# Secure and Remote 3D Printing Milestone Progression

Tiffanie Petersen - tpetersen2018@my.fit.edu

Isaiah Thomas - ithomas2018@my.fit.edu

Carl Mann - cmann2013@my.fit.edu

Nick Contrell - ncontrell2019@my.fit.edu

Progress of current Milestone (progress matrix)

Task	Completion %	Tiffanie	Carl	Isaiah	Nick	To do
1. Implement, test, and demo the remote printing of a gcode project through the web application.	0%	0%	0%	0%	0%	Other senior design team has taken the 3D printer home (no access)
2. Implement, test, and demo edge cases for web application usage.	70%	0%	0%	70%	0%	Test edge cases of printing
3. Implement, test, and demo queue system for current projects.	75%	0%	75%	0%	0%	Change deletion to print (see Task #1), aesthetic
4. Upload docker to Raspberry Pi	0%	0%	0%	0%	0%	Waiting to hear if we can take over the other groups pi when they graduate
5. Create a higher level systems diagram which better conveys the interactions of the user, raspberry pie, octoprint / web application, and the printer.	100%	100%	0%	0%	0%	
6. Services/software deployment diagram allocating	100%	100%	0%	0%	0%	

software to a device						
7. Request raspberry pi and other materials	100%	0%	100%	0%	0%	

1. Discussion (at least a few sentences, ie a paragraph) of each accomplished task (and obstacles) for the current Milestone:

   ■ Task 1: We could not work on task 1 this milestone because the other senior design team took the raspberry pi and printer to their house causing us to no longer have access to them.

   ■ Task 2: Added security measures for website features. The web server is protected from memory exhaustion by enforcing file size and amount limitations. To protect from local file inclusion attacks, the file signatures are analyzed to ensure only G-Code files are uploaded. Additionally, all uploaded files have permissions explicitly set as read and write only. User-input titles are also cleansed and restricted to a specific length to avoid injection attacks and overflows.

   ■ Task 3: Staff level users are provided a view of all the uploaded G-Code files in a queue. The queue provides details on the file (title, date, size, etc.), allows downloading of the file to the user's local filesystem, and option to delete selected files from the queue & web server.

   ■ Task 4: Uploading the docker to the raspberry pi has been postponed due to not having the new raspberry pi and that the other team has taken the printer and pi home.

   ■ Task 5: Created a new diagram to better show how the user will need to interact with the web application. It will also highlight the higher level of interaction of the web application and the software needed for proper functions. We basically remade the system architecture diagram to include how the software interacts with each other.

   ■ Task 6: For the services and software deployment diagram we made two. There is the basic one of how the software needs to interact with the raspberry pi and there is another that shows how each of the functions of the web application will be added in phases which will then be added to to raspberry pi. The second diagram is a gitflow diagram to show how features are being added to the web application and how we ensure that merge conflicts do not occur.

   ■ Task 7: The raspberry pis have been out of stock, so we have sent in a new request. There is another software that we were thinking of requesting as well which would help to pentest the web application/ 3D printer.

2. Discussion (at least a few sentences, ie a paragraph) of contribution of each team member to the current Milestone:

- ■ **Tiffanie Petersen:** Tiffanie has focused on the new diagrams that were needed. Which means she made the higher level systems architecture diagram, a software diagram, and the sprint implementation diagram. She also kept everyone informed of meetings that the team was expected to meet up in person for as well as cancelations due to illnesses in the group. She also was the primary writer for the milestone evaluation and helped when the team ran into issues implementing the new features of the web application.

- ■ **Carl Mann:** Reorganized the code for better comprehension and modifiability. Implemented system of least privilege access for views and features of the website. Created Queue webpage and functionality for staff users, enabling G-Code file downloading, and removal of items from the queue and web server. Identified needed materials for cybersecurity testing of the Ender-3 printer.

- ■ **Isaiah Thomas:** Implemented security screenings of uploaded files, including but not limited to: file size limiting, file signature restriction, file read-write only permissions, file storage segregation, and title length. The site now ensures that an uploaded file may not be executed and uploaders are limited to size guidelines in order to combat potential abuse of the storage system. File signature restriction and the sanitation of titles prevents user injection attacks.

- ■ **Nick Contrell:** Did not work on the project this milestone. He did talk to the group in discord, but stopped responding right before the due date.

3.   Plan for the next Milestone (task matrix) or [skip if this is for Milestone 6]

Task	Tiffanie	Carl	Isaiah	Nick
Enhance website appearance	25%	25%	25%	25%
Final website functionality	25%	25%	25%	25%
Deploy website	25%	25%	25%	25%

Begin MitM of 3D printer	25%	25%	25%	25%

4. Discussion (at least a few sentences, ie a paragraph) of each planned task for the next Milestone or "Lessons Learned" if this is for Milestone 6

- ■ Task 1: We plan to overhaul the style again to hopefully make the formatting correct. The github was redone again to get rid of unneeded files which was causing confusion and overwriting style changes.

- ■ Task 2: Based on feedback from faculty and users, add any further required and/or desired features to the website before deployment. Items considered at this time include: account confirmation emails, external file storage (e.g., Amazon S3, microSD card), lower privilege queue view.

- ■ Task 3: Install a docker image on a Raspberry Pi and use it to deploy the website. This has been pushed because we were originally using the raspberry pi that was connected to the 3D printer, but now we might be ordering a new one.

- ■ Task 4: Transition team to probing cybersecurity of the 3D printer. Using a device such as the GreatFET One, conduct a man-in-the-middle attack on the USB connection to the printer. After detecting and storing sufficient traffic, analyze the requests and responses to determine viable attack vectors for future fuzzing.

5. Date(s) of meeting(s) with Client during the current milestone:
   - ■ None

6. Client feedback on the current milestone

   - ■ The client will be met once the project proceeds further. Depends on when Dr. Siddhartha Bhattacharyya decides the product is ready.

7. Date(s) of meeting(s) with Faculty Advisor during the current milestone:
   - ■ 11/29/21

8. Faculty Advisor feedback on each task for the current Milestone

   - ■ Task 1:

      - ➢ Next milestone, show a demo showing octoprint interfacing and printed trials.

   - ■ Task 2:

- ➢
  - ■ Task 3:
    - ➢
  - ■ Task 4:
    - ➢ Allowed to upload to the other teams raspberry pi as long as it does not slow it down.
  - ■ Task 5:
    - ➢ Answered all questions I had previously.
  - ■ Task 6:
    - ➢
  - ■ Task 7:
    - ➢ Send off message to Harris Design Center regarding FET and Pi

Faculty Advisor Signature: _____ Date: _____

Evaluation by Faculty Advisor

- **■** **<u>Faculty Advisor: detach and return this page to Dr. Chan (HC 214) or email the scores to pkc@cs.fit.edu</u>**
- ■ Score (0-10) for each member: circle a score (or circle two adjacent scores for .25 or write down a real number between 0 and 10)

Tiffanie Petersen	0	1	2	3	4	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
Carl Mann	0	1	2	3	4	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
Isaiah Thomas	0	1	2	3	4	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
Nick Contrell	0	1	2	3	4	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10

Faculty Advisor Signature: _____ Date: _____