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## Summary

The main goal of this week is to collect data on indoor jamming experiments. Unlike previous tests, test values were measured under the environment in which ESP32 were placed on different floors.

While making the data-loader and visualization function for the jamming data, Chirpstack JSON file format and The Thing Network JSON file format were different. Modification of the data-loader was required. After the revision, all the data were organized and visualized.

For the final presentation, scripts were made and revised. During the preparation, the structure of the paper was also reconsidered.

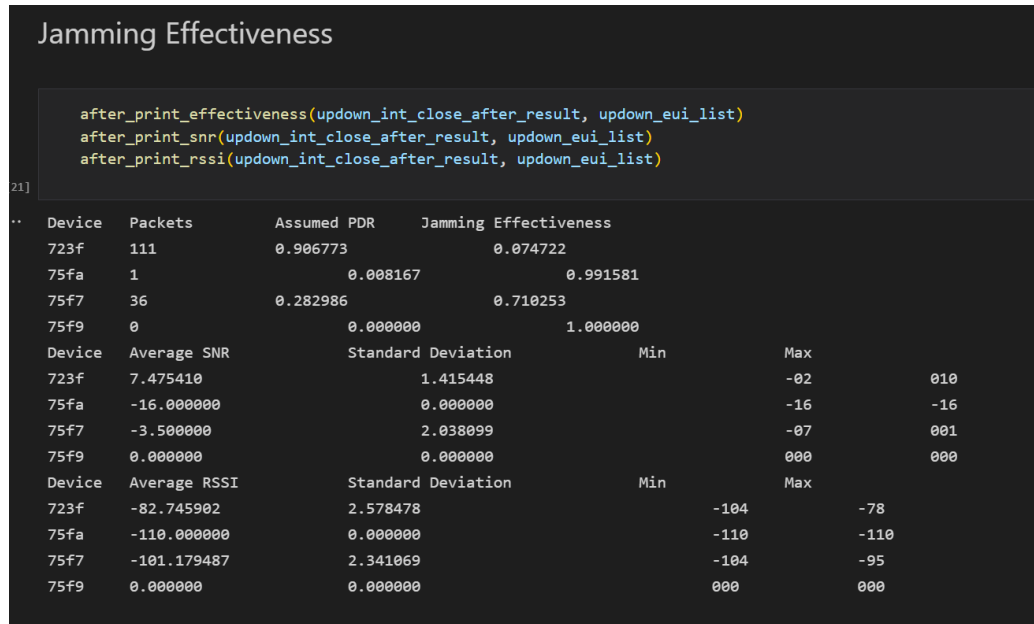
## What 454P completed this week:

- Measure effect of jamming on different floors

<b>3F</b>	<b>ESP-32</b> (723f)	<b>Gateway</b>	
<b>2F</b>	<b>ESP-32</b> (75fa)		
<b>1F</b>	<b>ESP-32</b> (75f7)		
<b>B</b>	<b>ESP-32</b> (75f9)		

**Figure 1. Placement of the ESP-32 in different floor**

The four ESP32 devices were located on each floor of Knoy Hall, as shown in figure 1. In order to assess the jamming attack performance, SM, which works as a server, was placed near the gateway, and AP, which works as a client, was placed about 20m away with doors and wall obstacles in between.



**Figure 2. The result of the experiment with different floors**

Figure 2 shows that jamming worked more effectively than the experiment that ESP32 devices were placed on the same floor. The fact was derived that gateways distributed across floors are more effective in preventing jamming.

- Conduct intentional jamming experiment



**Figure 3. Intentional jamming locations**

In previous experiments, there was enough distance between SM and AP. Placing both Canopy devices in the same location was easier to conduct jamming. The experiment was conducted in Knoy hall to prove jamming performance in this manner. Locations of intentional jamming was A, B, and C, which is shown on Figure 3. Comparing close and far distance results, jamming effectiveness decreased as the Canopy devices were far away from the gateway.

- Preprocess data of the JSON file

The JSON file obtained from the Chirpstack was preprocessed using Python. Chirpstack JSON files had a different format from The Things Network [1], [2]. For this reason, the existing function could not be used. According to the official document, Frame Payload was encrypted using binary large object (BLOB) [3] and Base64 [4]. However, there was the issue that meaningless bits were inserted. To solve this problem, frame count was used to check whether a packet was sent correctly. All functions written on Jupyter Notebook were organized as a library for convenience.

### Things to do by next week

- Complete preparing the final presentation
- Complete the Implementation and Conclusion part of the paper
- Revise the Introduction part of the paper based on the feedback

### Problems or challenges:

- Problem with decoding the Base64 based BLOB

The payload value in Chirpstack JSON file is a BLOB encoded by Base64 [5]. It was used in TTN JSON file using python codes to decode Base64 encoded string. However, using the same code in the Chirpstack JSON file, the value was just a random number and hard to understand. After searching the Chirpstack forum, there was a problem with the payload value in Chirpstack server. Therefore, we decided to use the frame count of the packet to check PDR.

### References

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- [2] ChirpStack, "Event Types", chirpstack.io,[Online]. Available: <https://www.chirpstack.io/application-server/integrations/events/>. [Accessed: 09-Dec-2022].
- [3] MDN, "Blob.", developer.mozilla.org, [Online]. Available: <https://developer.mozilla.org/en-US/docs/Web/API/Blob>. [Accessed: 09-Dec-2022].
- [4] MDN, "Base64.", developer.mozilla.org, [Online]. Available: <https://developer.mozilla.org/en-US/docs/Glossary/Base64>. [Accessed: 09-Dec-2022].
- [5] ChirpStack, "Command." chirpstack.io, [Online]. Available: <https://www.chirpstack.io/docs/chirpstack-gateway-bridge/payloads/commands.html>. [Accessed: 09-Dec-2022].