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# Introduction

Air-gapped systems are physically isolated from public or unsecured networks such as the internet, making them a preferred solution for securing highly sensitive data. However, research has shown that even these isolated systems are not entirely immune to attack. Malicious code can exploit electromagnetic (EM) emissions to leak information. While numerous studies demonstrate the feasibility of EM-based attacks, fewer focus on how attackers can evade adaptive detection mechanisms that assume emissions are static or easily characterized.

# Context

This project investigates how a Raspberry Pi 4 can be used as a covert transmitter, leveraging its electromagnetic emissions to transmit data from an air-gapped system. Much of the feedback we initially received focused on the need for a more engaging and accessible presentation. After being invited to present at Night of the Nerds, we were encouraged to improve the storytelling aspect of the project, leading to the development of a themed design.

# Phase 1: Story Development

Our group brainstormed various storytelling concepts until the SpongeBob SquarePants Krabby Patty storyline inspired us. I developed a hardware design and created a poster to align with this theme. This storytelling approach was well received. It made the project not only accessible to a wider audience including those without deep technical knowledge but also entertaining.

# A screenshot of a video game Description automatically generated

Figure 1 V1 story board

# Night of the Nerds Presentation

In preparation for Night of the Nerds, we were advised to make the project more interactive. This led to the creation of the Burger Treasure Hunt. The interactive element works as follows: when a spectrum analyzer is held above the power supply of the Raspberry Pi, it detects electromagnetic signals encoding different burger ingredients, including the Krabby Patty’s secret recipe. Participants were encouraged to locate the "sweet spot" on the decorated Raspberry Pi to complete the burger.

A white sign with text and food on it

Description automatically generatedThe project became a standout attraction on our floor during the event, generating significant interest. Feedback was overwhelmingly positive, highlighting the creativity, fun factor, and accessibility of the concept. A game design teacher provided constructive suggestions, noting the uniqueness of the controller concept but recommending improvements to the user feedback loop suggesting that participants should feel like their actions have a more tangible impact. While this suggestion is beyond the current scope of the project, it presents a valuable opportunity for future iterations.

A toy car on a book

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A group of people posing for a photo

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A person standing in front of a white board

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Figure 5 Winners league afterwards