



# Florida International University

## Knight Foundation School of Computing and Information Sciences

### Fall 2024 Senior Design Project

# Medical IoT Security

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## PROBLEM

**Sprint One:** The first sprint entailed learning about our roles as a group and then researching what medical IoT entails. In our first Sprint we dug deep and researched on Medical IoT security and how we can produce our own implementations.

**Sprint Two:**We needed to solve the issue of keeping medical devices in the hospital network safe from cyber threats. These devices send important patient data, and we had to ensure they work securely and correctly.

**Sprint Three:** With this sprint we developed stories to develop and research some features we would like to have for our product. Such as researching methods of a firewall and how it can work, developing and researching an EKG monitor system, an MRI machine system, and a EEG system for our project.

**Sprint 4:** In this sprint, we focused on the hospital’s problem of tracking medical devices, how the lack of real-time communication between the network and the devices leads to inefficiencies, and security risks like network traffic not being addressed immediately.

**Sprint Five:** In this sprint we all began to put the final touches on our projects and began to start collaborating our findings and deceiving how we will incorporate and combine our results.

**Sprint Six and Seven:** For this sprint, the problem was trying to put all of our individual work in order to create a website and a final product where all the functions work perfectly together, given that until this sprint, all of us used different platforms for our assigned work.

## SYSTEM DESIGN

**Sprint One:** The initial system design was not determined yet. We knew that we had to start with a firewall(s) and medical devices for configuration.

**Sprint Two:** The system design focused on setting up a secure network that connects all the devices with a firewall to keep data safe. Each medical device needed to be set up in a way that allowed them to share information securely. We also planned for encryption and security checks to make sure only the right people could access the data.

**Sprint Three:** The original system design in mind was for an application to view these devices and as well their individual statuses from the firewall.

**Sprint Four:** Creation of hospital network system with integrated device management, communication, and added security.

**Sprint Five:** The system design was still under review as that is what we spent the majority of our time these sprints doing beside putting final touches on our projects.

**Sprint Six and Seven:** GitHub-based collaboration model where each member is able to work on a specific task in a collaborative platform.

## VERIFICATION

**Sprint One:** Our verification process consisted of running tests to see if the devices we developed were connected on the network. We had to constantly adjust the configurations via the medical device and the firewall. We also had to ensure that the network connection was stable for us to continue verifying the device connectivity.

**Sprint Two:** We tested each device to make sure they worked correctly and the firewall kept everything secure. We checked the accuracy of the data from the EKG, MRI, and EEG to make sure they could detect issues properly. Finally, we tested the system to see if it could handle real-life hospital situations.

**Sprint Three:** We came together to verify that each pieces of our research fit well with the design and goal of the project. We also collaborated to ensure that there was no issues present.

**Sprint Four:** To ensure the effectiveness of our solution, we tested the system by simulating real hospital scenarios. We checked that all medical devices, such as EKGs, EEGs, and MRI machines, communicated with the network in real time and verified that data transfer was secure and uninterrupted. Additionally, we tested the firewall's ability to detect and block suspicious network traffic immediately, confirming the system addressed inefficiencies and enhanced security as intended.

**Sprint Five:** We all verified and made sure that all of our projects were completed before collaborating.

**Sprint Six & Seven:**Issues were fixed as needed and to ensure that the functions worked correctly.

## CURRENT SYSTEM

**Sprint One:** To start we did not have any system in place yet. We were discussing what contributions we could add to the Medical IoT development process. After our research we decided that we were going to incorporate a little bit of cybersecurity to fulfill our security goals.

**Sprint Two:** The current system didn’t have enough protection, which made it easier for hackers to attack the hospital network. Medical devices like MRI machines, EKGs, and EEGs worked individually, but they weren’t connected in a way that made it easy to monitor all the data at once.

**Sprint Three:** The current system we have does not really incorporate much of these core features, we ran into many roadblocks and developmental issues with what we have we made a very barebones system that incorporates cybersecurity elements.

**Sprint 4:** The manual tracking methods in hospitals lead to delays and inaccuracies. It is also difficult to share the location using devices on a network that have very limited communication capabilities. The security measures are mostly basic and lack firewall protection.

**Sprint five:** Our system was still being determined for the most part as we were putting our final touches on our projects to then collaborate our findings

**Sprint Six and Seven:** Most of our individually assigned work was done individually except for the discussions to see how much work we completed. Team communication was mostly done through WhatsApp and sometimes zoom, which wasn’t enough to figure out how to effectively collaborate together.

## OBJECT DESIGN

**Sprint One:** Similarly to the system design we did not have an initial design we were going for. We started off focusing on the development of the devices and the firewall.

**Sprint Two:** In object design, we created specific parts for each device, like the EKG, MRI, and EEG, so they could communicate securely with each other. These parts (called objects) made sure the devices could do their jobs and stay safe from cyber threats. We also designed the system to easily add new devices later.

**Sprint Three:** The object design portion was difficult as we did not have a concrete plan of what design we originally wanted. We did have an idea of if it should be an application or a website that contained the previously mentioned elements like the EEG, EKG, and firewall.

**Sprint Four:** The objects include devices such as medical equipment, network, and the firewall, each with specific roles.

**Sprint Five:** After many group discussions we decided to move forward with the website and we began to plant out how we would combine all our findings.

**Sprint Six and Seven:** In order to gain a better understanding of how we wanted to put our work together, we had to do research on the website and development aspects. After that, we worked on tweaking the components of the website and looked for ways to improve it, if necessary.

## SUMMARY

**Sprint One:** This was a great start to our project. Initially it started off with a lot of research but we were able to implement everything that we learned into our project. Overall Sprint One was a great sprint and a great way to kick off the rest our our semester.

**Sprint Two:** In this sprint, we successfully built a system that keeps medical devices in the hospital safe and ensures they work well together. The firewall and devices were designed, set up, and tested to meet both safety and functionality needs. The team worked together to create a system that helps doctors and nurses monitor patients more efficiently and securely.

**Sprint Three:** The goal of this sprint was very much early development and also research for our goal product. While there was a lot to figure out with the team we came together to start putting pieces together and research more devices.

**Sprint 4:** The goal of sprint four was to complete all of our individual contributions. We all were working on medical device configuration and firewall connectivity. We were each able to complete out tasks effectively.

**Sprint Five:** The goal of this sprint was finalize all individual projects and begin the early stages of putting together all our findings for the website.

**Sprint Six and Seven:** These sprints demonstrated the importance of streamlined workflows and the importance of collaborative tools in order to facilitate effective implementation of the website and the final product.

## REQUIREMENTS

**Sprint One:** Our requirements were having a firewall and a plethora of medical devices that we would start developing and finding ways to configure them to connect to the firewalls we had in place.

**Sprint Two:** We needed to create a firewall that could protect the entire hospital network. The medical devices, like the EKG, MRI, and EEG, had to work together securely and share information. The system also had to be able to grow and add more devices in the future.

**Sprint Three:** We needed to develop better systems for security purposes of medical devices such as firewalls and more. We also pursued highly advanced technologies to make which may have made development difficult.

**Sprint 4:** We need a system that is able to identify all the devices on the network. We further require communication protocols in order to share devices in real-time as well as firewall to detect and block traffic.

**Sprint five:** The requirements for this sprint was for us to finish all of our prototypes and have the final version as we had to begin corroborating our findings.

**Sprint Six and Seven:** It was necessary for us to create a unified platform for code integration and collaboration. This was a crucial step to minimize confusion and uncertainty, and put all of our work into a single product, that is, the website.

## IMPLEMENTATION

**Sprint One:** The implementation in this sprint was collaborative. We all selected a device, ex: EKG, MRI Machine, that we would develop. We also configured our firewalls and the connectivity process with the devices.

**Sprint Two:** We set up the firewall, connected the devices to the network, and made sure they could communicate securely. We also made sure each device, like the EKG, MRI, and EEG, could track and send accurate data. During this step, we added security measures, like encryption, to protect patient information.

**Sprint Three:** There was no current implementation of these systems yet, we were still in the research phase of deciding how we want to implement these features into our product.

**Sprint Four:** Developed features for device identification, location tracking, and network communication using secure protocols.

**Sprint Five:** We all implemented our final touches on our projects to then begin collaborating our results.

**Sprint Six and Seven:** The website creation was a collaborative process, with each member working on specific aspects of the website, starting from the research phase to putting together the final website.

## REFERENCES

Sprint One:  
<https://www.paloaltonetworks.com/network-security/medical-iot-security>  
<https://asimily.com/blog/iot-device-security-top-4-ways-to-secure-your-healthcare-iot-devices/>  
<https://www.paloaltonetworks.com/cybersecurity-perspectives/iot-adoption-in-healthcare>  
Sprint Two:[https://ordr.net/solutions/healthcare?utm\\_medium=cpc&utm\\_source=google&utm\\_campaign=%7Bcampaignname%7D&utm\\_content=690706826158&utm\\_term=cyber%20security%20for%20healthcare&rm\\_ci=11308918528&rm\\_gid=114806177030&rm\\_kw=cyber%20security%20for%20healthcare&rm\\_mt=p&rm\\_n=g&rm\\_cr=690706826158&qad\\_source=1&qbraid=0AAAAAC1NsX9-c8ZO1Nrzf12hxEaTaXgJ&gclid=CjwKCAiA0rW6BhAcEiwAQH28lti\\_ifYPQ9MHfvLoZXpIU-T81RMoQRLfITdo1YF5oIBJxlzZSH89GB0CsboQAVd\\_BwE](https://ordr.net/solutions/healthcare?utm_medium=cpc&utm_source=google&utm_campaign=%7Bcampaignname%7D&utm_content=690706826158&utm_term=cyber%20security%20for%20healthcare&rm_ci=11308918528&rm_gid=114806177030&rm_kw=cyber%20security%20for%20healthcare&rm_mt=p&rm_n=g&rm_cr=690706826158&qad_source=1&qbraid=0AAAAAC1NsX9-c8ZO1Nrzf12hxEaTaXgJ&gclid=CjwKCAiA0rW6BhAcEiwAQH28lti_ifYPQ9MHfvLoZXpIU-T81RMoQRLfITdo1YF5oIBJxlzZSH89GB0CsboQAVd_BwE)  
Sprint Three:<https://www.nist.gov/cyberframework>  
Sprint Four:<https://www.needle.tube/resources-44/Common-Discrepancies-in-Hospital-Supplies-and-Equipment-Inventory-Management--Addressing-Manual-Tracking,-Demand-Underestimation,-and-Lack-of-Communication?srsltid=AfmBOoDZneCm69gWwIQT6-QQPx2QJLMHuzKpvlLApuEGCck5m2Cze9L>  
Sprint Five:  
[https://www.archonsecure.com/blog/medical-device-iot-security-risk-solutions?hs\\_amp=true](https://www.archonsecure.com/blog/medical-device-iot-security-risk-solutions?hs_amp=true)  
Sprint 6 & 7:  
<https://everhour.com/blog/what-is-github/#:~:text=Further%2C%20GitHub%20allows%20developers%20to,scratch%2C%20thanks%20to%20simple%20actions.>  
<https://www.somar.co.nz/blog/collaborative-web-development/#:~:text=Why%20is%20collaboration%20important%20in,fosters%20a%20client%20centric%20approach.>

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