ILLINOIS

INTEGRATIVE DESIGN AND PROCESSING OF ENVIRONMENTAL IOT AND MICROSCOPY DATA VISUALIZATION

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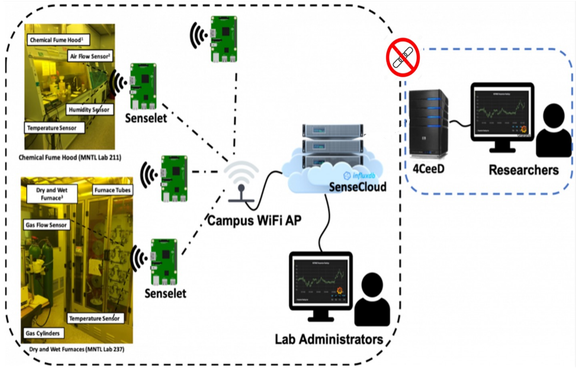
Abstract and Introduction

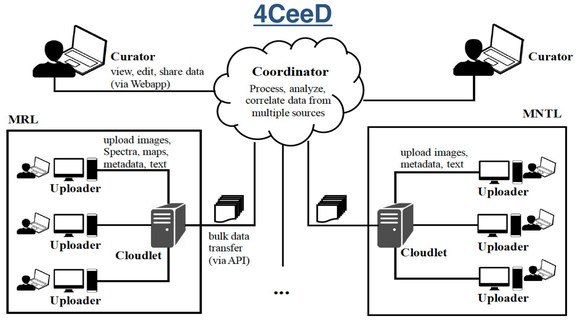
The environment consists of the 4CeeD and Senselet systems that lie under The Timely and Trustworthy Curating and Coordinating Data Framework (T2C2) that drastically reduce the materials-to-device process often span several decades. Semiconductor cleanrooms used in research to fabricate devices often deal with minute particles that must be dealt with exceptionally carefully and need experimental and environmental monitoring. The 4CeeD and Senselet systems allow researchers and scientists to collect, archive, analyze, and share collected digital data from labs and testing sites before archiving and publishing it for widespread usage [1]. These cloud systems exist separately and have very different methods of authentication, access control, and data storage. While these two data management systems have benefitted researchers and shortened scientific research and materials-to-device processes — they still lack smooth integration. Scientists and researchers have to manually correlate data between the two platforms in a highly tedious and inefficient way. They do not have a way to view the external sensor data for their experiments in the 4Ceed system and are therefore unable to detect anomalies or trends easily. Since being able to correlate the external and experimental data stored in the two different platforms is extremely helpful for researchers, this project integrates the two. This poster discusses the design and integration between the 4CeeD and Senselet frameworks. It speaks about the fusion and correlation of data in the 4CeeD system using MongoDB from the Senselet database InfluxDB in a secure and coordinated manner.



The separate Senselet (left) and 4CeeD (right) Systems (The goal of this project is to connect these two systems) [1]

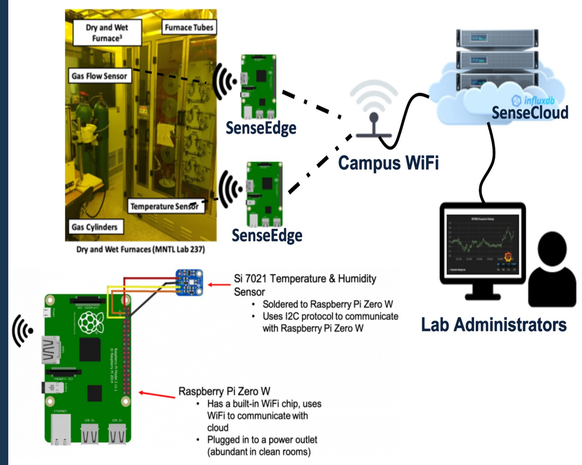
4CeeD and Senselet

4CeeD



- The 4CeeD system leverages the Clowder framework developed at the National Center for Supercomputing Applications & focuses on capturing, correlating, and coordinating the data obtained in real-time across various experiments & fields.
- 4CeeD is an intelligent data management system that leverages the advantages of shifting to the cloud, i.e., privacy, security, and scalability.

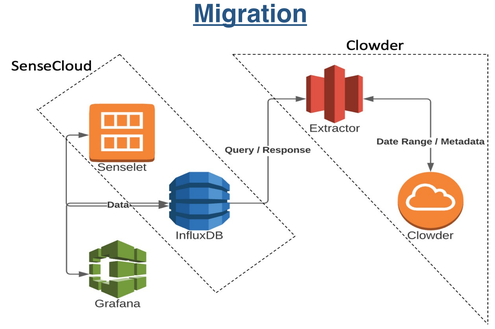
Senselet



- Senselet is an intelligent distributed sensing system with a Sensory IoT Network Infrastructure for Scientific Lab Environments.
- Senselet allows us to seamlessly correlate and synchronize the sensory data with the instrument data (and metadata) in real-time, allowing better monitoring and control.

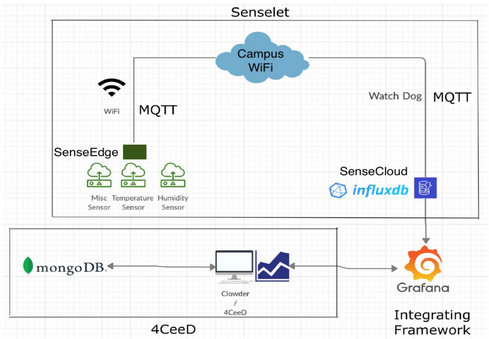
Integration Framework Design

Migration



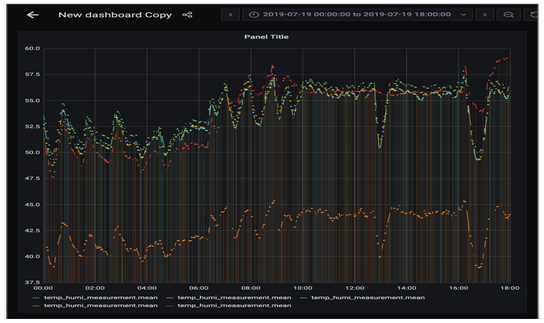
- This migration will allow the 4CeeD system to store the external sensor data in addition to the internal microscopy data.
- This approach can be developed efficiently using extractors where users can trigger an extraction service in 4CeeD that can query, process and post the metadata to the dataset.
- Doesn't require any modification to the front end & functions as a backend extractor service that is already integrated into the 4CeeD interface.

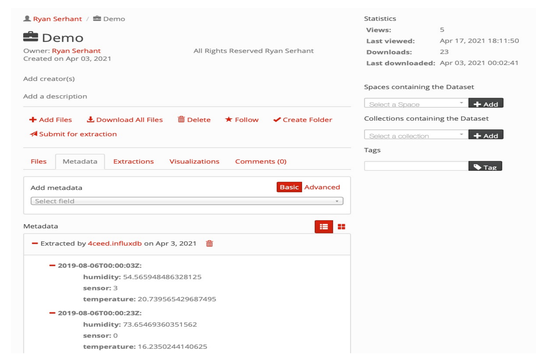
Embedding iFrame Panel



- An iframe allows us to display another webpage within 4CeeD, thereby allowing users to view and interact with a different platform and context.
- This approach allows researchers to view, analyze, correlate and interface with data from Senselet in 4CeeD.
- Displaying Grafana dashboards that visualize data stored in Senselet's InfluxDB allow scientists to analyze trends and anomalies easily.

User Interface Through 4CeeD





- Ultimately, the project involves using an iframe to visualize data from Senselet with the help of Grafana inside 4CeeD and an extractor to migrate data between the two platforms.
- This framework solves the critical issue researchers face where they cannot efficiently correlate scientific data between Senselet and 4CeeD. It removes the tedious and manual process scientists faced in analyzing and visualizing environmental data concerning their experiments. .
- The implementation can be found on GitHub at https://github.com/ribhavjain/Integrative-Design-and-Processing-of-Environmental-IoT-Microscopy-Data-Visualization

Acknowledgements

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