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SENSELET++: A Low-cost Internet of Things Sensing Platform for Academic Cleanrooms Beitong Tian, Zhe Yang, Hessam Moeini, Ragini Gupta, Patrick Su, Robert Kaufman, Mark McCollum, John Dallesasse, Klara Nahrstedt

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Abstract and Introduction

Sensory IoT (Internet of Things) networks are widely applied and studied in recent years and have demonstrated their unique benefits in various areas. In this paper, we bring the sensor network to an application scenario that has rarely been studied - the academic cleanrooms. We design SENSELET++, a low-cost IoT sensing platform that can collect, manage and analyze a large amount of sensory data from heterogeneous sensors. Furthermore, we design a novel hybrid anomaly detection framework which can detect both time-critical and complex non-critical anomalies. We validate SENSELET++ through the deployment of the sensing platform in a lithography cleanroom. Our results show the scalability, flexibility and reliability properties of the system design.

System Deployment



We deployed 16 sensors and 4 edge devices in Holonyak Micro and Nanotechnology Laboratory (HMNTL) in UIUC. The system has run 8 months and generated new and useful findings of the cleanroom.

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Academic Cleanroom Environment Environment Microscope Fume-hood **Characteristics of Academic Cleanrooms** Highly diverse research tasks conducted by researchers. Highly diverse scientific equipment. Highly diverse users. Constrained budget to build and maintain the IoT system. **Monitoring Tasks** Controlled fail success Environmental Monitoring: Environmental parameters like humidity temperature and dust around instruments need to be monitored and controlled to ensure the success of the experiment.

Instrument Monitoring: By monitoring the temperature of the pump, we can determine if the pump is in a healthy state. By monitoring the airflow of fumehood and HVAC systems, we can make sure the toxic gas does not undermine the safety of researchers.

Security Monitoring: By monitoring the door at the entrance, we can detect violated access to cleanrooms.



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