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DEVELOPMENT OF WIRELESS SENSING PROTOTYPE, "STAMPS" FOR DATA ACQUISITION, ANALYSIS, AND VISUALIZATION.

Abstract

As humanity extends beyond low earth orbit to the moon, explorers will need new technology to support expanding habitats. Furthermore, these explorers will need increased autonomy from Earth based support resources. This pilot project furthers the research and development efforts towards a new lunar habitat support technology designed to enable crew to perform on-the-fly investigation of suspected faults in habitat systems or sub-systems. The Dynamic Anomaly Response and Integrated Analysis (DARIA) system utilizes a system of wireless sensing prototypes called "stamps", derived from Commercial Off-The Shelf (COTS) sensors, to perform on-the-fly data acquisition, analysis, and visualization of raw data and data products. The scale and concept of operations for the hand-sized stamps allow for implementation onto off-world habitats such as the International Space Station (ISS) with almost zero overhead as crew can simply place a stamp on a system to be investigated to start the data acquisition and integrated analysis process. This paper will detail the engineering research and development process for initial project prototypes. The prototype effort may be divided into three subtasks: 3D printing the physical fixture, Internet of Things (IoT) wireless connectivity, and a unified data bus demonstration. 3D printing of the fixture involved utilizing computer aided design (CAD) software to create various prototypes from polylactic acid filament (PLA) that were used for testing and integration. Using the NASA IoT Platform, which is a novel approach to establish the connectivity between the sensing system and the users who interface with them, the goal is to connect the project's COTS Sensors with an easily accessible and intuitive user interface. Several sensors were evaluated and integrated on a single data bus including a hydrogen sensor, a sound sensor, a humidity sensor, a temperature sensor, and an inertial sensor or IMU. This paper will show initial results, including data from the sensors, and initial prototype design. The next steps of this project are also discussed and include the finalization of the stamp fixture design, completion, and testing of the IoT connection, and integrated tests of the full data pipeline leading up to a data display.