

Low-Cost Wireless self-healing sensor network (LoWSHAN)
Hassan Adam, Ydidiya Assefa, Jeff Villanueva
Mentor: Dr. Venkatesan Muthukumar

One of the most challenging aspects of monitoring and remote sensing in deserted or harsh environments is sacrificing accuracy or cost. As seen recently in the Atmospheric Remote-sensing Infrared Exoplanet Large survey (ARIEL), which cost the European space agency 550 million dollars. Our work demonstrated the capabilities of creating a relatively low-cost monitoring and remote sensing network. Our Low-Cost Wireless self-healing sensor network (LoWSHAN) system is a mesh network capable of monitoring and sensing uninhabited regions. LoWSHAN is flexible such as it can measure a diverse set of physical properties and variables from temperature, soil moisture, humidity, and air content in areas uninhabited and adverse regions. LoWSHAN has three primary nodes: the sensing node, dynamic gateway node, and static gateway node.

The system uses a low-powered wide-area radio frequency called LoRa to communicate between the nodes. The static gateway nodes use a raspberry zero as an IoT gateway device to connect to cloud storage. At the same time, the dynamic gateway nodes explore the region to find a connection between two or more range sensing nodes. The testing of the prototype showed the system's capabilities. Within the area of Las Vegas, we had a functioning connection of up to 300 meters. Accounting for urban and human radio frequencies, we can upgrade this range to 1000 meters if placed within an uninhabitable area. We believe that LoWSHAN's capabilities will significantly help NASA in its ability to monitor vast uninhabited areas at a relatively low cost.