

## ***Internet of Things Team: A Geospatial Web Portal for Visualizing and Analyzing***

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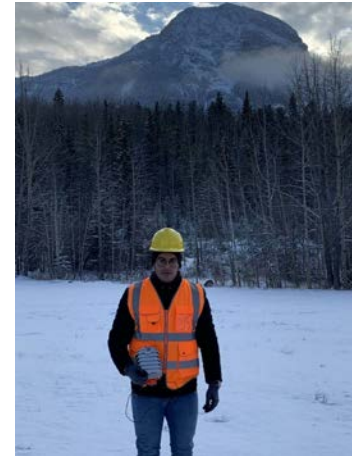
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### **Project Summary**

Constant monitoring of environmental conditions has produced an increasing need for visualizing and analyzing observations from heterogeneous Internet of Things (IoT) sensors. The main objective of this project was to provide an interactive geospatial web portal to provide a scalable infrastructure for publishing and accessing spatial and temporal distributions of a heterogeneous sensor network. The low-cost and low-power IoT sensors including temperature, light, humidity, and motion detector sensors that can measure different environmental parameters. Using the most popular mapping platforms (*i.e.*, Cesium and MapBox), two versions of geospatial web portals were designed and implemented to support both 2D and 3D map visualizations. Both platforms can automatically add unlimited number of sensors and visualize their datastreams at various locations. Optimizing query-based interactions (*i.e.*, an appropriate mix of using HTTP and MQTT protocols) between the portal and backend server and applying hierarchical geospatial visualization based on the zoom levels make the developed dashboard scalable. By clicking on each location, all historical timeseries will be visualized in the graph section and can be compared with each other over time. Using the geospatial web portal, heterogeneous data from heterogeneous IoT sensors can be extracted, transferred, loaded, visualized, and aggregated for further analytics. It can be used with Matlab, R, Mathematica, and ESRI for efficient access to real-time and historical data.



### **Management Implications and Lessons Learned**

Developing an interactive geospatial web portal to visualize spatial and temporal distribution of heterogeneous IoT sensor network is an important management implication in making informed decisions for managers, analysts, stakeholders, and public policymakers. The interactive and scalable geospatial web portal, firstly, connects to all sensors have been deployed in the field. The connection process will be done automatically without any users' intervention. Secondly, it provides access to real-time and historical data for all connected sensors and provide a rich data infrastructure for further data analysis. Thirdly, different sensors can be compared temporally using a graph representation. Finally, spatial distribution of sensors is visualized on a map and simple clustering approaches considering sensors' distance and reporting status (*i.e.*, being online or offline) are applied to provide more efficient visualization in different map zoom levels.

### **Publication(s)**

Both versions of the web portals have been publicly available since March 2020.

- <https://bera-3d-dashboard.s3-us-west-2.amazonaws.com/index.html>
- <https://bera-2d-dashboard.s3-us-west-2.amazonaws.com/index.html>