

## **Development of a Connected Smart Vest for Improved Roadside Work Zone Safety (04-104) Dataset**

Dataset available at: <https://doi.org/10.15787/VTT1/PMIRWK>

(This dataset supports report **Development of a Connected Smart Vest for Improved Roadside Work Zone Safety**)

This U.S. Department of Transportation-funded dataset is preserved by the Virginia Tech Transportation Institute (VTTI) in their data repository (<https://dataverse.vtti.vt.edu/>), and is available at <https://doi.org/10.15787/VTT1/PMIRWK>

The related final report **Development of a Connected Smart Vest for Improved Roadside Work Zone Safety**, is available from the National Transportation Library's Digital Repository at <https://rosap.ntl.bts.gov/view/dot/60309>.

### **Metadata from the VTTI Repository record:**

Dataset Persistent ID: doi:10.15787/VTT1/PMIRWK

Publication Date: 2021-01-15

Title: Development of a Connected Smart Vest for Improved Roadside Work Zone Safety (04-104)

#### Author:

- Roofigari-Esfahan, Nazila (VT) - ORCID: 0000-0003-0466-0893
  - Mollenhauer, Mike (VTTI) - ORCID: 0000-0002-7595-8489
  - White, Elizabeth (VTTI) - ORCID: 0000-0003-2854-4301
  - Vilela, Jean Paul Talledo (VTTI) - ORCID: 0000-0003-4988-6968
- Description:
- Project Description:
    - Roadside work zones (WZs) present imminent safety hazards for roadway workers as well as passing motorists. In 2016, 764 fatalities occurred in work zones in the United States due to motor vehicle traffic crashes. A number of factors (aging highway infrastructure, increased road work, increased levels of traffic and more nighttime WZs) have led to an increase in WZ crashes in the past few years. Consequently, WZs are becoming increasingly dangerous for workers as well as passing motorists. The standard work zone safety signage and personal protective equipment (PPE) worn by workers at roadside WZs have not been completely effective in controlling work zone crashes. A viable solution to this problem is to design a wearable device to accurately localize, monitor, and predict potential collisions between WZ actors based on their movements and activities, and communicate potential collisions to workers, passing drivers, and connected and automated vehicles (CAVs). This project aims to develop a wearable worker localization and communication device (i.e., Smart Vest) that utilizes the previously developed Threat Detection Algorithm (Safe-D project 03-050) to communicate workers' locations to passing CAVs and proactively warn workers and passing motorists of potential collisions. As a result, this research is expected

to significantly improve the safety conditions of roadside WZs through prompt detection and communication of hazardous situations to workers and drivers. The Smart Vest work zone system allows to monitor worker's location on a deployed work zone who are wearing the Smart Vest device by reading their GPS data and provide two-level alert patterns when they are approaching to a dangerous location defined by a virtual polygon using the Smart Vest Geo Plotter. Smart Vest computing system allows to gather, log and process GPS data for each Smart Vest device deployed on a work zone. Along with a Geo-Plotter device which is used to create a virtual polygon around the work zone by taking 3 or more points, the system collects the GPS position data for each device, process and determine if the location is inside the virtual polygon. To classify the location, the system determines 3 different location types: "Safe Zone", "Low Level Warning Zone" and "High Level Warning Zone". The Low level and safe zones are inside the virtual polygon. Each time the computing system determines a Smart Vest device is crossing between zones, an alert (HMI) is transmitted to the specific device. This alert is auditory/visual and tactor based.

- Data Scope:
  - A total of 39286 datapoints were collected on a field test work zone setup at VTTI – Automation HUB. The collected data set includes data entries for three Smart Vest devices while moving around a virtual polygon area defined by the Smart Vest Geo Plotter device. The virtual polygon area was defined using 4 point polygon (square shape) and the three Smart Vest were worn inside and outside the virtual polygon and their GPS location was processed to calculate their classification and trigger the proper HMI warnings accordingly when crossing between Safe Zone, Low-level warning area and High-level warning area.
    - Three log files are being provided:
      - GPS Log which contains the Device ID, GPS position, Speed. Every single entry has a timestamp field with date and time.
      - Polygon Log which contains the entries (GPS Latitude/Longitude and Counter) to determine the virtual polygon using the Geo-Plotter device.
      - Work zone Log which contains the classification for each GPS location received by the system using 0,1,2 as Safe Zone, Low Level Alert Zone and High-Level Alert zone respectively.
- Data Specification:
  - WZL Log File
    - Time stamp: date and time for data received.
    - ID: Smart Device ID for the data entry.
    - Latitude: GPS Latitude value for the Smart Vest Device Position (degrees)
    - Longitude: GPS Longitude value for the Smart Vest Device Position (degrees)
    - Classification: Location classification: 0= Safe Zone, 1=Low Level Warning Area, 2 = High Level Warning Area.

- POL Log File
  - Time stamp: date and time for data received.
  - ID: Smart Device ID for the data entry.
  - Counter: Virtual Polygon vertex number
  - Latitude: GPS Latitude value for the Smart Vest Device Position (degrees)
  - Longitude: GPS Longitude value for the Smart Vest Device Position (degrees)
- GPS Log File
  - Time stamp: date and time for data received.
  - ID: Smart Device ID for the data entry.
  - Latitude: GPS Latitude value for the Smart Vest Device Position (degrees)
  - Longitude: GPS Longitude value for the Smart Vest Device Position (degrees)
  - Heading: Smart Device GPS Heading value (degrees)
  - Speed: Smart Device GPS Speed value (meter per second)

Subject: Engineering

Keyword: Smart Vest, GPS, Work Zone

Depositor: Atkins, Whitney

Deposit Date: 2021-01-13

**Recommended citation:**

Roofigari-Esfahan, Nazila; Mollenhauer, Mike; White, Elizabeth; Vilela, Jean Paul Talledo, 2021, "Development of a Connected Smart Vest for Improved Roadside Work Zone Safety (04-104)", <https://doi.org/10.15787/VTT1/PMIRWK>, VTTI, V1

**Dataset description:**

This dataset contains 1 file collection, described below.

**Development of a Connected Smart Vest for Improved Roadside Work Zone Safety\_Data.zip**

- GPS\_Log2020-10-06\_02-42-27-449.log
- POL\_Log2020-20-06\_02-42-27-449.log
- WZL\_Log2020-10-06\_02-42-27-449.log

The file extension .log is frequently used for log files. Such files are usually in plain text file format and are used by many programs (for more information on .log files and software, please visit <https://www.file-extensions.org/log-file-extension>).

A log generally contains a record of which program processes were requested at which times.

**National Transportation Library (NTL) Curation Note:**

As this dataset is preserved in a repository outside U.S. DOT control, as allowed by the U.S. DOT's Public Access Plan (<https://doi.org/10.21949/1503647>) Section 7.4.2 Data, the NTL staff has performed *NO* additional curation actions on this dataset. NTL staff last accessed this dataset at <https://doi.org/10.15787/VTT1/PMIRWK> on 2022-04-21. If, in the future, you have trouble

accessing this dataset at the host repository, please email [NTLDataCurator@dot.gov](mailto:NTLDataCurator@dot.gov) describing your problem. NTL staff will do its best to assist you at that time.