

Quarterly Report – Public Page

Date of Report: *April 3, 2012*

Contract Number: *DTPH56-10-T-000021*

Prepared for: *Department of Transportation/Pipeline and Hazardous Materials Safety Administration*

Project Title: *Advanced Learning Algorithms for PIGPEN*

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For quarterly period ending: *March 31, 2012*

Public Page Section –

Work Completed During this Quarterly Period

Progress in evaluating the self-learning abnormality algorithms that are to be tested in this project continued during this reporting period. Previously, we described a quantity called the State-Sequence Index (SSI) that quantifies statistical information captured in sensor signal features. Improbable SSI values are deemed abnormal, quantified as an “Abnormality Coefficient” (AC). AC coefficients > 2 are significant. During this period, using data acquired at our Army test site, we correlated AC with video images and data logs.

Also during this period, we progressed with coding the software and firmware for implementing the self-learning abnormality classification algorithms in the real-time sensor and alarm system. Fabrication of next-generation hardware for the field tests also progressed; the sensor elements are fully assembled and tested. Assembly of the first prototype in a new installation configuration is underway at Heath Consultants.

General Information required on all Public Quarterly Reports

Results and Conclusions:

Figure 2 plots the AC vs time for over two hundred events captured on video. Most of the events were pickup tracks passing along the road near the sensors. These events are plotted in blue, all other events are plotted in red. Because truck occurrences were so frequent, especially during working hours, the algorithm learned to classify them as

“normal”. Thus, they generally do not cause a significant increase of AC except at unusual times of day (e.g. Sept 6, 3:40 am).

There are a number of non-truck events that do not exhibit enhanced abnormality. At this point in the project, it is difficult to determine whether these are missed alarms, or if they are actually normal events when taken in context of time and day. The best examples are events on 9/13 and 9/14 resulting from nearby road traffic. On Tuesday 9/13, traffic around 2pm classifies as significantly abnormal. Yet on Wednesday 9/14, traffic at 11:12 am shows no deviation from normal. This may be interpreted as showing that pre-lunch traffic on Wednesday is normal activity, while mid-afternoon traffic on Tuesday is not normal at all. This is the type of outcome desired from the algorithm, and will be further tested during the planned extended field trials.

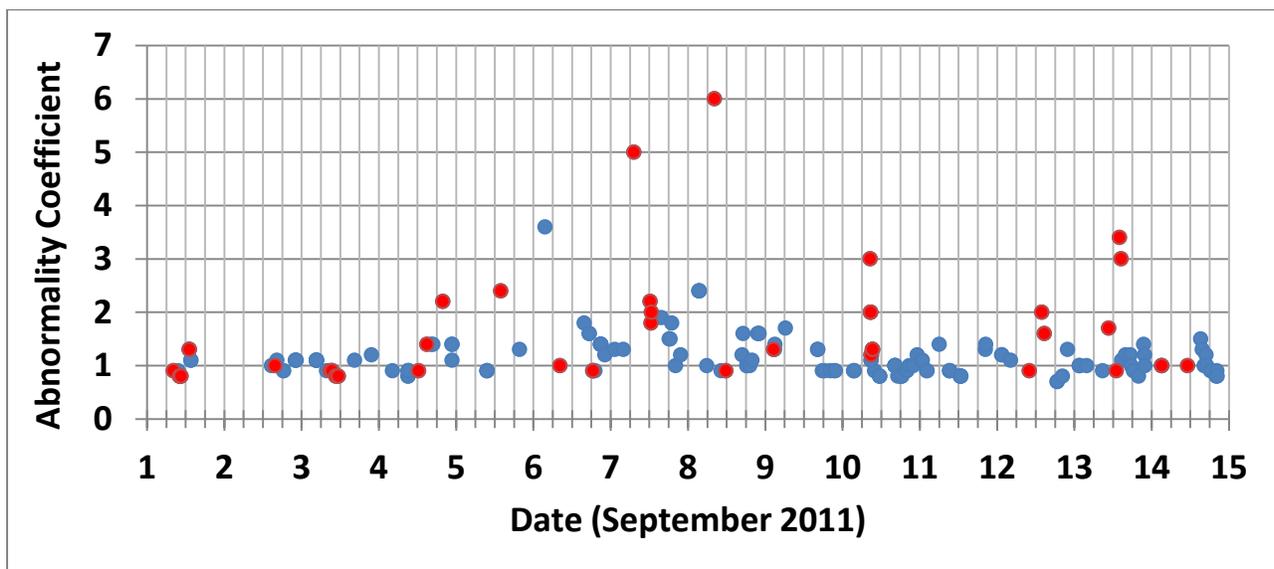


Figure 2. Abnormality coefficients for over 200 events recorded during the first two weeks of September 2011.

Plans for Future Activity:

PSI, with cost share and product development partner Heath Consultants, are progressing with sensor assembly. PSI and Heath have initiated discussions with pipeline operators to begin the process of scheduling field tests. At this time, we continue to envision the first tests occurring at commercial customer sites in June 2012, with NYSEARCH tests to follow in September – November 2012.