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A Nuisance Alarm Data System for Evaluation of Intrusion Detectors

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ABSTRACT

A Nuisance Alarm Data System (NADS) was developed to gather long-term background alarm data on exterior intrusion detectors as part of their evaluation. Since nuisance alarms play an important part in the selection of intrusion detectors for use at Department of Energy (DOE) facilities, an economical and reliable way to monitor and record these alarms was needed. NADS consists of an IBM Personal Computer and printer along with other commercial units to communicate with the detectors, to gather weather data and to record video for assessment. Each alarm, its assessment and the weather conditions occurring at alarm time are placed into a database that is used in the evaluation of the detector. The operating software is written in Turbo Pascal for easy maintenance and modification.

A portable system, based on the NADS design, has been built and shipped to other DOE locations to do on-site alarm monitoring. This has been valuable for the comparison of different detectors in the on-site environment and for testing new detectors when the appropriate conditions do not exist or cannot be simulated at the Exterior Intrusion Detection Testbed.

INTRODUCTION

The DOE has maintained an Exterior Intrusion Detection Testbed at Sandia National Laboratories to evaluate exterior sensors for use at DOE facilities. The data collection facilities at the Exterior Intrusion Detection Testbed were upgraded from obsolete minicomputers, a Nova 3 and a Nova 4, to a system designed around an IBM AT desktop computer. This was made possible because desktop computers, peripherals and accessories have been increasing in power and reliability while decreasing in cost. Another benefit is the maintenance can be performed by the operating personnel instead of requiring a maintenance contract from the computer manufacturer. The NADS was constructed for a cost of less than a 2-year maintenance contract on the old minicomputers.

When a sensor is chosen for evaluation, the test engineer studies the manufacturer's manuals to become familiar with the sensor. The installation procedures are followed along with the alignment instructions, sensitivity settings, and operational procedures to set up the sensor as recommended. The sensor performance is verified by walking, crawling, climbing and jumping: whatever is required to verify operation of the sensor. Any potential defeat methods are attempted and the final settings are made to put the sensor in the same condition it would be in when deployed at a DOE site. Now, the NADS begins its long term recording of alarms. The recording takes place continuously, except during the day shift when significant activity occurs in the testbed. By running every night, weekends and holidays the system can achieve 720 sensor operational hours and 500+ data collection hours per calendar month.

SYSTEM DESCRIPTION

The NADS system, whose block diagram is shown in Figure 1, consists of a console containing an IBM AT computer with a Digiboard 8-port serial board, two each RCA Model 2920 Time-lapse VCRs, two each Conrac model 2620 CCTV monitors, a RCA model TC1600 series 256 channel video switcher, a Heath Model IDW-5001 Weather Station, a Hewlett Packard Model 2932A printer and a Display Board. The console is shown in Figure 2. Located in the test field are ten Stellar Model TROS-8/4 transponders, the wind speed and wind direction boom for the weather station, a lightning sensor and a tipping bucket rain gauge. The lightning sensor and the rain bucket are monitored through a relay closure into a standard alarm channel. With the ten transponders, the NADS has the capability of monitoring 80 channels of alarms. Some sensors have more than just the alarm channel, such as a junction box tamper or a processor operational alarm. For evaluation purposes, each one of these alarms is monitored separately.

TESTBED

The Testbed (see Figure 3 for the layout) is made up of sections varying from 100 meters to 200 meters. Each 100 meter section has the lighting required and two CCTV cameras for alarm

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assessment. A pan and tilt CCTV camera, in the middle of the testbed, can be positioned to cover for failed cameras and to handle assessments for special tests outside of the testbed. The transponders are placed strategically about the field and communicate with the computer in the console over a daisy-chained single RS-422 data link. The transponders have two data channels with one channel being used and the other channel functioning as a spare. Each of the eight sensors connected to a transponder feed through a lightning surge clipper (see Figure 4 for sketch of the transponder link). All cables, including the data lines linking the transponders, run above ground in cable trays to keep the testbed flexible and able to respond quickly to new sensors or sensor configurations. However this makes the data link more susceptible to lightning than if run underground through conduits. Therefore, an external data line surge protector is added to the signal lines at each transponder.

SOFTWARE

The software is written in Turbo Pascal 5.0 and consists of five Pascal program modules: NADS, ASSESS, SETUP, SEARCH90, and BUILD. The program modules are selected from a master menu written as a PC-DOS batch file.

The data collection module, NADS, polls the transponders and responds to any alarms by switching the monitors to the alarmed sector, switching the VCRs from time-lapse mode to ten seconds of real time recording, reading the weather conditions, writing the alarm record to the hard disk, writing to the printer and the display board (see Figure 5). The printed record made during each data collection run consists of the channels that are active, the start time and stop time of the data collection run and all of the alarm records for that run. Each alarm record contains the alarm event number, channel number, type of sensor, date and time of the alarm, temperature, wind speed and wind direction. The weather is also recorded at ten minute intervals for a background weather history. The background weather file entries contain the date, time, temperature, wind speed and wind direction. The alarm assessments are made, after the data collection is stopped, by comparing the time of the alarm on the printed record with the time recorded on the VCR tape to find the alarm occurrence. The VCR tapes are examined closely and the cause of the alarm is noted.

The assessment module, ASSESS, brings up each alarm on the screen and asks for a keyboard entry of the alarm cause. When all of the assessments have been entered, the alarm data from the current run is appended to the collective monthly alarm file. Each alarm record, in the monthly alarm file, consists of the channel number, assessment, type of sensor, date, time, temperature, wind speed and wind direction. The current background weather data is appended to the collective monthly weather file. Each monthly alarm file and weather file is appended to a yearly alarm file and a yearly weather file for archiving purposes. Some other files, described next, are created to make a complete data collection system. A running total of on-time for each channel in maintained in the file TIMEON.DAT which is updated in the ASSESS module. The file PEAKWIND.DAT records the start and stop time for each run, time for the run, and the peak wind that occurred during that run. The new PEAKWIND data is updated in the ASSESS module.

The search module, SEARCH90, sorts the alarm file for alarms associated with an individual sensor, prints that record out and places the information in a output file. This output file, containing only alarms for one sensor, is used by the test engineer to analyze and plot the alarm data.

The module, BUILD, creates all of the files necessary to run NADS. It is only run once to initialize the data collection setup for each new Testbed.

The module, SETUP, is used to enter the details of each channel in the file SETUP.DAT. These details are whether the channel is active or not, the maximum number alarms to record on video for each channel on each run, which cameras will be used to record the alarms and the name of the sensor on the channel. It also is used to add new sensors and change entries when sensors are moved from one location to another. This configuration information is scanned each time the NADS program is run to set the run-time parameters.

PORTABLE SYSTEM

A portable system, based on the NADS design, was assembled from another set of components. This portable system consists of an IBM AT computer, an IBM Proprinter, a weather station, two transponders, two VCRs, two CCTV cameras and two CCTV monitors. The items not used from the NADS are the 8-port serial board and the Video Switcher. The VCRs, CCTV monitors and one transponder are mounted in a 19-inch rack that is 35 inches high. This transponder handles the rain bucket input, the lightning detector input and any other sensors whose processor is placed in the data collection room.

The second transponder is placed in the perimeter close to the sensors to be monitored. The wind speed and wind direction boom is mounted in the perimeter area. The Weather Station processor is placed on top of the 19-inch rack in the data collection room. The software to operate the portable system is the NADS software with only minor changes to fit the specific site.

Figure 6 shows the portable system in place at a DOE facility to record a test of a strain gauge sensor monitoring overhead lines crossing a perimeter. It also is recording two Microwave sensors and two Video Motion Detectors monitoring a steampipe crossing a perimeter. The CCTV cameras already in use in the perimeter are being utilized for the assessment cameras.

SUMMARY

The Nuisance Alarm Data System has been in daily operation for three years at the Exterior Intrusion Detection Testbed at Sandia National Laboratories. It has proven to be a reliable, low maintenance data collection system. During this time, a peak value of 45 channels were active at one time. Now fewer are in use but the full capacity remains operational and ready to be used if required. The portable NADS has been shipped to three other DOE locations for testing sensors and is now in use at a DOE site monitoring sensor tests.

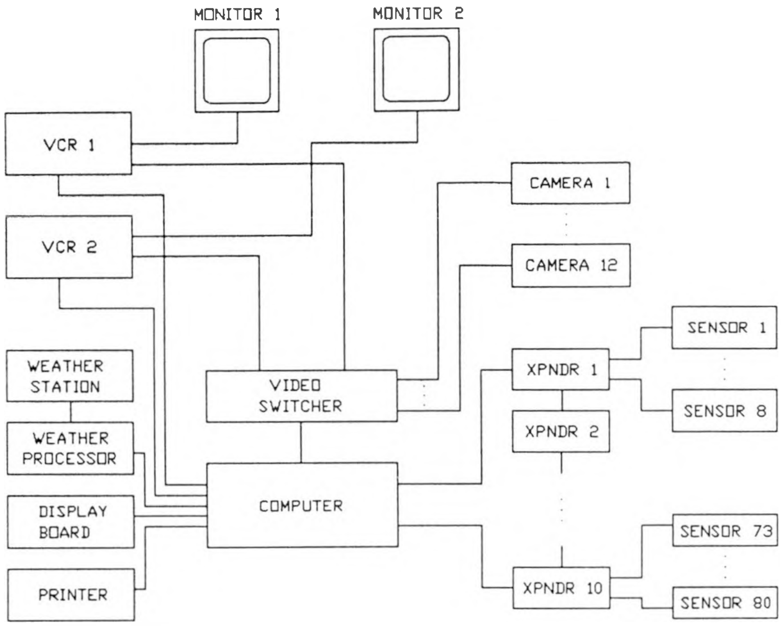
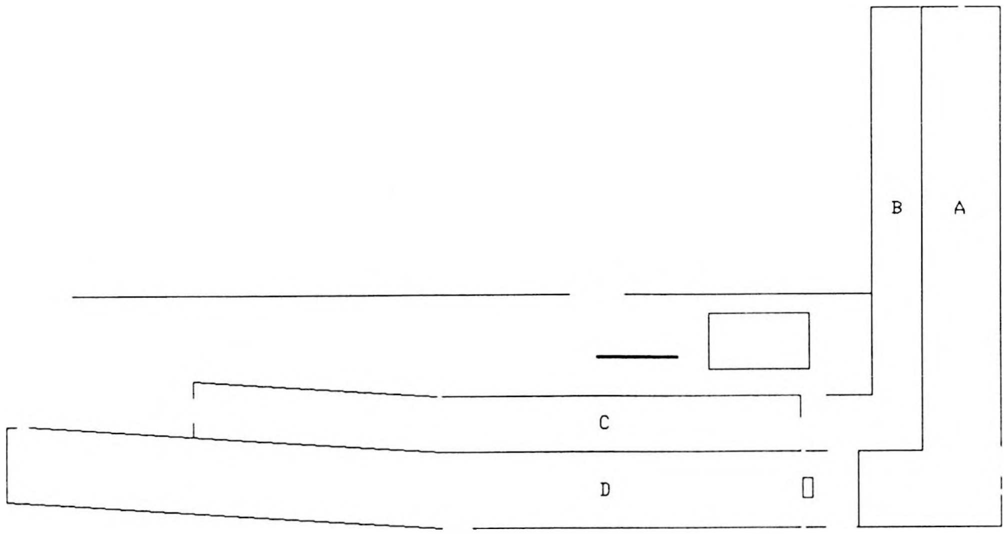


Figure 1. Nads Block Diagram

Figure 2. NADS Console



A - 120 meter section
B - 100 meter section
C - 150 meter section
D - 200 meter section

Figure 3. Testbed Layout

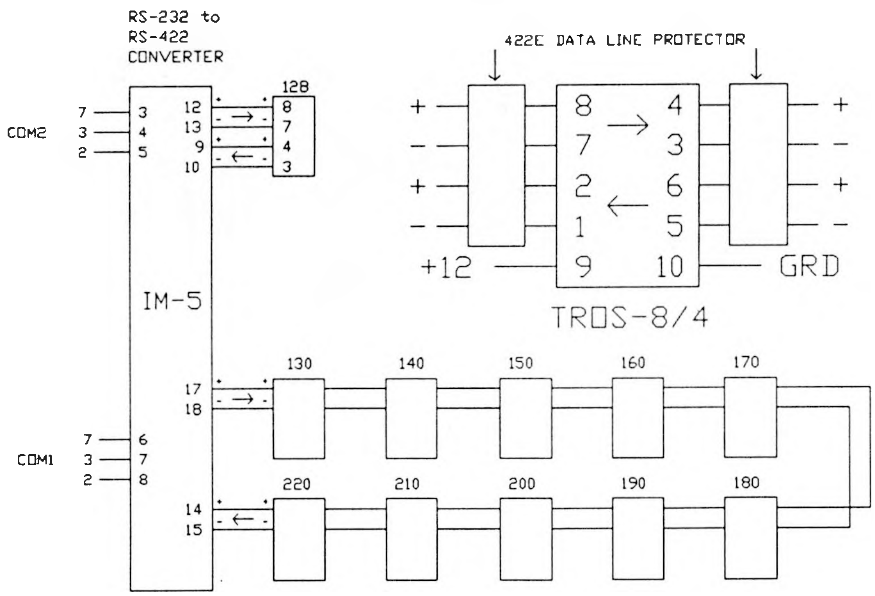


Figure 4. Transponder Link

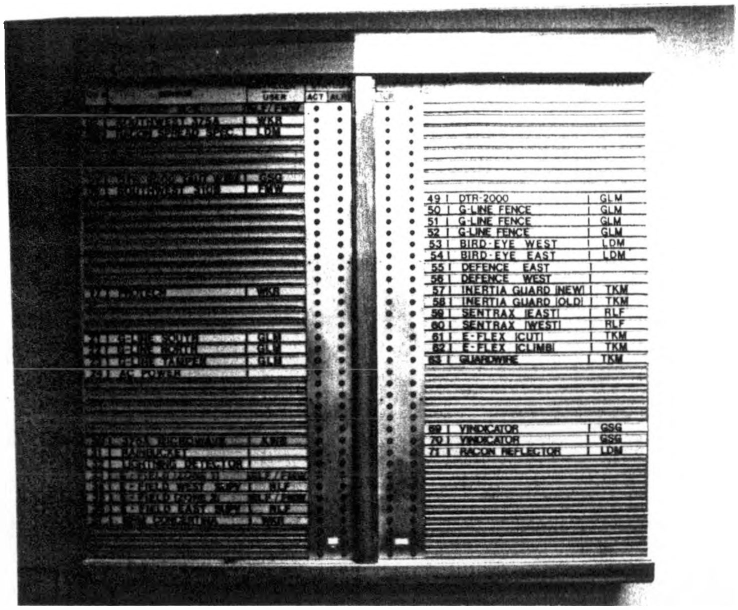


Figure 5. Display Board

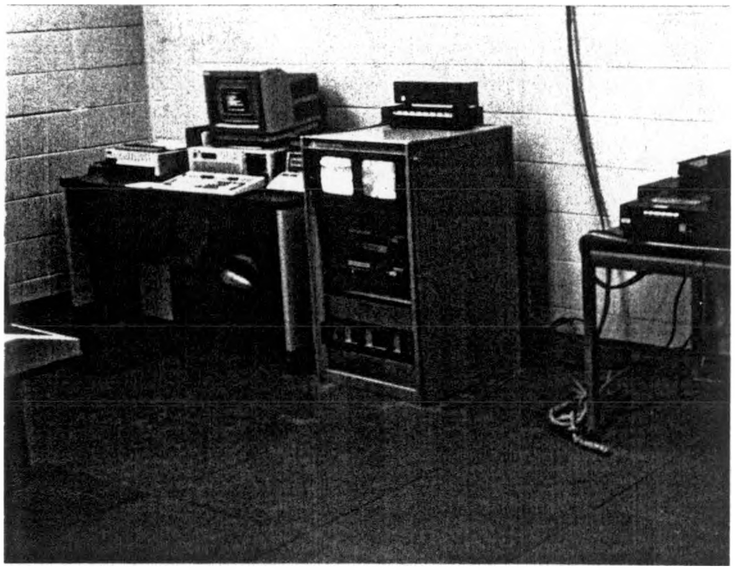


Figure 6. Portable System