



Mi-Forms Case Study: Federal Inspections with Digital Pen



Mi-Co was approached by an agency of the Federal government to make data collection easier for its regulation compliance inspections. The compliance monitoring activities of this agency require inspections of both equipment operated in public by individuals and equipment of retail outlets and wholesalers. Agency field inspectors conduct interviews with key personnel and collect relevant information about the equipment.

Challenges of the inspections include: some of the data is collected outdoors, making mobility and viewability of the solution a key requirement; laptops are not an option due to the need to collect data quickly and the concern that some interview subjects would be intimidated by them; and inspectors have only limited network access.

Objectives

- Same-day entry of collected information into a computer system.
- Preserve handwritten, pen-on-paper data entry – though inspectors had been given handheld, mobile computers in the past for data collection, they prefer to rely on paper forms instead.
- Eliminate manual transcription and reduce overall data entry time.
- Transfer data to back-end database via ODBC, and generate delimited text files for further analysis by another government contractor.
- Allow rapid entry of data, without requiring users to pause to correct handwriting recognition errors. Information that identifies the equipment is recorded quickly and continuously, and there is no time to review handwriting recognition results during data collection.

Tactics

To improve the data collection process, the agency added the digital Pen to its arsenal of data collection platforms with the Mi-Forms System. Because data collection is convenient via pen-on-paper handwriting and data entry time is reduced, correct data can be available in the computer system on the day of the inspections.

The Mi-Forms system was chosen because it meets the aforementioned challenges and objectives. In addition, the Mi-Forms system has demonstrated its flexibility by allowing the agency to use multiple data collection platforms. Besides using the digital Pen, field personnel have also used the HP Jornada Pocket PC connected to a special electronic pen on paper mounted atop an electronic clipboard. For both data capture platforms, Federal inspectors transfer the data to a laptop computer that performs complementary handwriting recognition, allows rapid review and verification of recognition results, transfers data via ODBC to existing back-end local databases, and generates comma separated data files.

The Federal government agency chose Mi-Forms because it electronically captures pen-on-paper data, and therefore is highly viewable and portable. Paper is easier to see in bright sunlight than a computer screen and can present much more information at any given time than the screen of a PDA. Writing on paper is comfortable, intuitive, and feels natural versus the slippery

displays of many PDA's. Field personnel prefer paper because interview subjects may be uncomfortable if their responses are keyed into a computer while they are present. In addition, typing in a subject's presence can be distracting because of the noise of the keyboard. Mi-Forms provides a "smart" client so that many forms can be collected during a shift and transferred in batch mode at the shift's end, using the modem of the field personnel's laptop. This mitigates the problem of limited network availability.

In order to meet the challenge of reducing data entry time, Mi-Forms handwriting recognition software was used. The handwriting recognition system converts handwriting to machine usable computer text (the "results"). Mi-Co's proprietary statistical method for presenting handwriting recognition results highlights ("flags") only the fields and characters that are likely to be in need of human verification before transfer to the back-end system. The user may set a level of errors that is palatable in the machine-accepted results ("unflagged" characters). Typically this error rate is set to match the error rates of human transcriptionists. Thus, in general, Mi-Forms is capable of alerting the user when it is unsure of a recognition result and likely to be wrong, and when it claims to be correct it is in fact correct with an accuracy corresponding to the level chosen by the user.

The Mi-Forms system includes a verification mode that allows rapid laptop-based review of handwriting recognition results. This system eliminates the need for users to pause to correct handwriting recognition errors during data collection, thereby making data collection efficient. The verification system highlights in red those results of which it is unsure. The user can rapidly accept correct results and access the next highlighted result via a single key. In fact, in verification mode, the system can be set to present only "unsure" results, cutting the number of characters that require human attention to a small fraction of the original characters. After presenting handwriting recognition results for review, the local verification tool populates customer databases via ODBC and/or generates delimited text files.

Results

In one field test, personnel spent one day inspecting publicly operated equipment. Because inspection information was recorded quickly via handwriting using the Mi-Forms system, over 1000 pieces of equipment were inspected in a single day.

Next, a direct comparison was made of the time taken to type the equipments' identifying information from the paper forms, versus the time taken to review the handwriting recognition results using the Mi-Forms system. Field personnel spent 10 man-hours keying the data directly from the paper over the course of several days, while it only took 3.25 man-hours to review the data using the Mi-Forms local verification tool on the same day as the inspections. Thus, Mi-Forms provided a savings in data entry time of 67.5%.

Conclusion

By using pen on paper processes and Mi-Forms verification software on a laptop, Federal inspectors are able to meet data collection objectives and overcome past challenges. Paper is preserved, data is available immediately after a rapid review process, the challenge of limited network access in the field is met, manual transcription is eliminated, data entry time is dramatically reduced, and back-end data transfer is accomplished.