RFID as Electronic Surveillance: Technology Performs Well in Feasibility Study

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Despite modern surveillance technology, retail outlets continue to be plagued by theft. Shoplifters have discovered various methods to deceive or elude electronic-surveillance systems.

Radio-frequency identification of products is one possible tool to combat theft, and the technology performed well in a new feasibility study on its use as a potential sales-floor theft-deterrent system. The study, conducted by researchers in the RFID Research Center at the University of Arkansas, demonstrated RFID's usefulness in several shoplifting scenarios, including many items moving through a security/reader portal at a high rate of speed and many items stuffed into a "booster bag," a traditional shopping bag lined with aluminum foil.

Bill Hardgrave, director of the research center and professor of information systems in the Sam M. Walton College of Business, announced the findings Sept. 10 at a two-day forum on item-level RFID hosted by the research center, the Voluntary Interindustry Commerce Solutions Association and the Council of Supply Chain Management Professionals.

"The most interesting data came from scenarios involving the booster bag and testers running through portals with many items," Hardgrave said. "These scenarios included many multiple RFID tags, and we were able to obtain a great deal of information at the entry/exit portal."

Researchers tested two types of ultra-high frequency, generation 2 RFID

tags in various baseline and shoplifting scenarios. The tests involved comparisons to two conventional systems, acousto-magnetic and low-level radio-frequency electronic article surveillance, currently used in many retail stores.

In the baseline tests, the researchers experimented with various tag locations and orientations as the tags moved through portal readers. In each test, the RFID system performed as well as or better than the conventional systems. The specific strength of RFID, as demonstrated in the baseline tests, was its ability to capture individual tags at various locations and orientations. Perhaps more importantly, the RFID technology recorded the total number of individual tags, while the other technologies simply noted the presence of any tag in the read field.

“Because RFID can uniquely identify individual tags, it can provide information on the number of stolen items within a bag or the number of items held by a shoplifter,” Hardgrave said. “Conventional systems cannot uniquely identify individual tags, which means they can report only one item in a bag that may have 20 or 50 stolen items.”

-- Fifty tagged items in a booster bag lined with aluminum foil. (The presence of metal tends to reflect ultra-high frequency signals and therefore reduces read rates.)
-- A tagged shoe worn by a shoplifter/tester exiting the store.
-- A tagged shirt, worn under a coat.
-- Tagged socks carried through the portal under a hat worn by a 6-foot-tall tester.
-- A standard shopping bag of 10 tagged items – an assortment of underwear, socks and shirts – moving through the portal at running speed.
-- Tagged socks held in a tester’s hand and tucked under the opposite arm.
-- A tagged item in the center of a full shopping bag of untagged items.

In the first scenario, both RFID and the conventional surveillance technologies achieved 100 percent success at detecting at least one stolen item. The researchers were encouraged that the RFID system captured 77.2 percent of all tags, despite the aluminum foil. Again, because the conventional systems do not uniquely identify each item, it was impossible to determine how many were read. The conventional technologies and RFID also scored 100-percent detection success in scenarios four (item placed under a hat), five (ten tagged items held by a tester running through the portal) and seven (one tagged item in a bag of untagged items).

In the second shoplifting scenario – a tagged shoe worn by a tester walking through the portal – the RFID system was 95-percent successful. Hardgrave said this result demonstrated a weakness with the RFID system in that it did not read all tags at the foot level. Scenario three, a tag placed on the collar of a shirt worn under an untagged jacket, also exhibited a weakness. Hardgrave attributed this finding to the tag's proximity to the tester's body, which likely absorbed radio-frequency energy and thus compromised the system's ability to read tags. Likewise, in the sixth scenario – tagged socks held in a tester's hand and tucked under the opposite arm – the RFID system did not perform as well as the conventional surveillance technologies. Again, the human body acting as a shield had a stronger effect on readability of RFID tags.

"Body proximity had an adverse effect on read rates," Hardgrave said. "That is something we will investigate further. In general, though, RFID fared well. Clothing and cloth material did not significantly interfere, and moving the tags though the portal at different heights did not significantly affect success, either. To see that speed of movement did not cause decreased performance was very encouraging. Overall, RFID performed adequately enough to warrant further investigation."

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