New 'ATM' takes old phones and gives back green

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With support from the NSF Small Business Innovation Research program, ecoATM of San Diego, Calif., has developed a unique, automated system that lets consumers trade in old electronic devices for reimbursement or recycling. Credit: ecoATM

When new cell phones or tablets enter the marketplace, yesterday's hot technology can quickly become obsolete - for some consumers. For others, the device still has value as an affordable alternative, or even as

spare parts.

With support from the National Science Foundation (NSF), ecoATM of San Diego, Calif., has developed a unique, automated system that lets consumers trade in those devices for reimbursement or recycling.

Using sophisticated artificial intelligence (AI) developed through two NSF Small Business Innovation Research (SBIR) grants, ecoATM kiosks can differentiate varied consumer electronics products and determine a market value. If the value is acceptable, users have the option of receiving cash or store credit for their trade - or donating all or part of the compensation to one of several charities.

ecoATM finds second homes for three-fourths of the phones it collects, sending the remaining ones to environmentally responsible recycling channels to reclaim any rare earth elements and keep toxic components from landfills. ecoATM is certified to the eWaste environmental standards of Responsible Recycling (R2) and ISO 14001.

"The basic technologies of machine vision, artificial intelligence, and robotics that we use have existed for many years, but none have been applied to the particular problem of consumer recycling," says ecoATM co-founder and NSF principal investigator Mark Bowles. "But we've done much more than just apply existing technology to an old problem - we developed significant innovations for each of those basic elements to make the system commercially viable."

ecoATM received its first NSF support in 2010, then received follow-on funding from Coinstar, Claremont Creek Ventures and Silicon Valley Bank to launch the first kiosks in 2011. The company expanded to the Washington, D.C. metropolitan area and other areas along the east coast this month, and plans to have more than 300 kiosks deployed by the end of 2012 in shopping malls and large stores across the country.

The system began as a wooden-box prototype that required the presence of an ecoATM representative to ensure that users were being honest with their trades. While that setup proved consumers would be comfortable with the device-exchange concept, it was limited by the need for human intervention.

ecoATM kiosks are manufactured in this facility by project partner D&K Engineering of San Diego, Calif. Credit: ecoATM

The first NSF SBIR grant allowed ecoATM to develop artificial intelligence and diagnostics that delivered 97.5 percent accuracy for device recognition, removing human oversight and making the system viable for broad use. A follow-on NSF SBIR grant is helping ecoATM close that final 2.5 percent accuracy gap.

According to Bowles, traditional machine vision generally relies on pattern matching, pairing a new image to a known one. Pattern matching is a binary approach that cannot handle the complexity of ecoATM's evaluation process, which includes eight separate grades based on a device's level of damage.

"We are now able to tell the difference between cracked glass on a

phone, which is an inexpensive fix, versus a broken display or bleeding pixels, which is generally fatal for the device," says Bowles. "We were warned by leading machine-vision experts that solving the inspecting/grading problem-with an infinite variety of possible flaws-was an impossible problem to solve. Yet with our NSF support, we solved it through several years of research and development, trial and error, use of artificial intelligence and neural network techniques."

The company's databases are now trained with images of more than 4,000 devices, and when an identification mistake occurs, the system learns from that mistake.

When a user places their device into an ecoATM kiosk, the AI system conducts a visual inspection, identifies the device model and then robotically provides one of 23 possible connector cables for linking it to the ecoATM network (the company warns consumers to erase all personal data before recycling).

Using proprietary algorithms, the system then determines a value for the device based on the company's real-time, worldwide, pre-auction system. Within that system, a broad network of buyers have already bid in advance on the 4,000 different models in eight possible grades, so the kiosk can immediately provide compensation.

A number of robotic elements enable the kiosk to safely collect, evaluate and then store each device in a process that only takes a few minutes.

"The ecoATM project is an extremely innovative way to motivate the public with an incentive to 'do the right thing' with discarded electronics, both socially and environmentally," says Glenn Larsen, the NSF SBIR program officer overseeing the ecoATM grants. "This may change behavior from simply dumping unwanted electronics to a focus on recycling, while helping put more hi-tech devices in the hands of others

that might not otherwise be able to afford or acquire them."

The company is partnered with San Diego-based D&K Engineering to help design and build the kiosks domestically, and has expanded from an original workforce of less than 10 in 2010 to a team of more than 150 employees and contractors today.

Since its founding, ecoATM has filed over 20 patents, been awarded seven patents to date, and won numerous awards. The company is currently one of three finalists for a Consumer Electronics Association (CEA) Inaugural Innovation Entrepreneur Award.

"ecoATM meets the required thresholds of both convenience and immediate financial incentive necessary to inspire mass consumer participation in electronics recycling," adds Bowles. "We believe we are the first system to achieve those thresholds."

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