Personal, Public: Using DIY to explore citizen-led efforts in urban computing

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CHI 2010, April 10–15, 2010, Atlanta, Georgia, USA.
ACM 978-1-60558-930-5/10/04.

Abstract
As communities develop technological literacy and explore how technology can impact their lives, the future of urban computing will come from grass-roots initiatives in addition to traditional top-down urban planning. To this end, we aim to engage the do-it-yourself (DIY) community in exploring how individuals can add technology to their communities. As design probes into this space, we have built prototype devices around off-the-shelf technology, open-ended interactions and simple engineering techniques familiar to the DIY community. Through evolving these devices with both the technical DIY community and Pittsburgh's local communities, we hope to spark citizen-led efforts in bringing novel applications of computing to our communities.

Keywords
cameras, community, diy, government, photography, public performance, story telling, throwies, ubiquitous computing, urban computing, urban planning

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms

Design

Introduction

Multiple forces now encourage individual citizens to begin experimenting with the role of technology in their local communities. Centralized governments are making their full public records available online. The open software and hardware movements allow motivated citizens to affordably deploy technology in public spaces. Finally, a trend towards location-based functionality in technology, from city-centered news blogs to GPS-based emergency services, is encouraging geographic communities to build technology resources with local needs in mind. These forces will move citizen-led efforts in urban computing from data crunching and communication in cyberspace to deploying physical technology into physical, public spaces.

Such hybrid digital-physical approaches to urban computing are not uncommon. Recent work exists in, among other areas, urban sensing using city-wide public infrastructure (for instance, street sweepers [1]) to engage local community activist groups, creating interactive context-dependent tourist experiences [6] and urban sensing to aid urban planning at the city level [2]. However, they have traditionally been organized and deployed from top-down perspectives more typical of those used in traditional urban planning and government. Our work differs in that anticipates grass-roots, citizen-created urban computing experiences that directly reflect the ideals and concerns of individual citizens and the various sub-communities and causes to which they belong. We hope that this focus on individuals, particularly through engagement of the do-it-yourself (DIY) community, we will gain a deeper understanding of how technology will ultimately define our public spaces.

This is not to argue that technology in public spaces will become completely citizen-run. More likely, we hope and expect that local governments will support community-led efforts in urban computing in the same way that they already support recycling programs and soup kitchens.

We are engaged in designing and building a number of small devices designed to explore how individuals can contribute technology to their environments. These projects are designed with cost, ease of construction and ease of deployment in mind, to encourage rapid experimentation by both members of the DIY community and local community leaders. Specifically, we engage the DIY community through publishing our techniques on sites like Instructables and by encouraging the reverse-engineering of off-the-shelf electronics in our designs. The local community is then engaged both collectively, through conversations with government officials, and at an individual level, by working with people of various occupations and professions to encourage local exploration.

These devices are controlled by Atmel microcontrollers common to hobbyist communities. These chips are soldered directly to transistors, which are in turn connected to the innards of off-the-shelf electronics in order to control them. As of now, all construction can be done with parts found in a typical high school electronics lab, and nothing requires more than a high school knowledge of circuitry and programming to build. We are developing printed circuit boards for

some of these projects for further ease of construction, and we hope to make boards available for purchase and resale to encourage public experimentation with these devices.

Variations On A Theme: The Throwie

Our devices took inspiration from the growing prevalence of technology in electronic graffiti, particularly the "Throwie" movement. The term "Throwie" comes originally from the "LED Throwie", a piece of electronic urban graffiti invented by Graffiti Research Labs in New York City in 2006. An LED Throwie is created by taking an LED, a watch battery and a magnet and taping them all together such that the LED leads connect to either side of the battery and the magnet is exposed. Then, the whole device is tossed onto a public metal surface, where it sticks and the LED glows for others to see. [3] The DIY community now uses "Throwie" as a general term for any electronic circuit placed in a public setting by throwing and attaching via a strong magnet. Following this work and related work with "Talking Throwies" that use a microcontroller to blink LEDs in a programmed manner [5], we explored how "Throwies" might be extended further using cheap off-the-shelf and hobbyist microcontrollers as a platform for exploring personalization, telepresence and public performance in shared spaces.

We started by building prototypes of the "Floating Throwie." This device was a circuit consisting of an LED, magnet and watch battery combination, as well as a microcontroller, a transistor, a pager motor attached to the magnet, and a pair of large helicopter paper wings attached to the whole circuit. After being tossed up, the Floating Throwie turns on the attached pager motor, allowing itself to vibrate free from the magnetic surface and float down (its movement dictated by the helicopter paper wings.) It is designed to create a light show in the soft drifting of the LED. (The "Floating Throwie" prototype is still being engineered.) To reduce the weight of the device, all leads are soldered together directly, with no circuit board used.

We then created the similarly-constructed "Motown Throwie". Instead of attaching a pager motor to the transistor, a music chip with a built-in play-back speaker torn from a Hallmark greeting card is wired to and operated by the microcontroller. After the device is turned on, placed on a public surface via a magnetic backing and some time has passed (enough time for someone to find a hiding spot from which to watch people's reactions), the speaker plays whatever the greeting card company placed on the music chip - in this case, "Ain't Too Proud to Beg" by the Temptations. We hope that by finding a community interested in such devices, we can test people's response to such indirect musical performances in public space.

Finally, our "Ventriloquist Throwie" is nearly identical to the Motown Throwie, except it is built from a greeting card that allows the sender to record personal, 10-second messagesonto the chip for playback. The device can thus be thrown up and will play back an arbitrary audio recording (such as "Watch your step!" or "Vote Today!".) It is designed to explore the usefulness of indirect audio communication with passersby in public spaces.

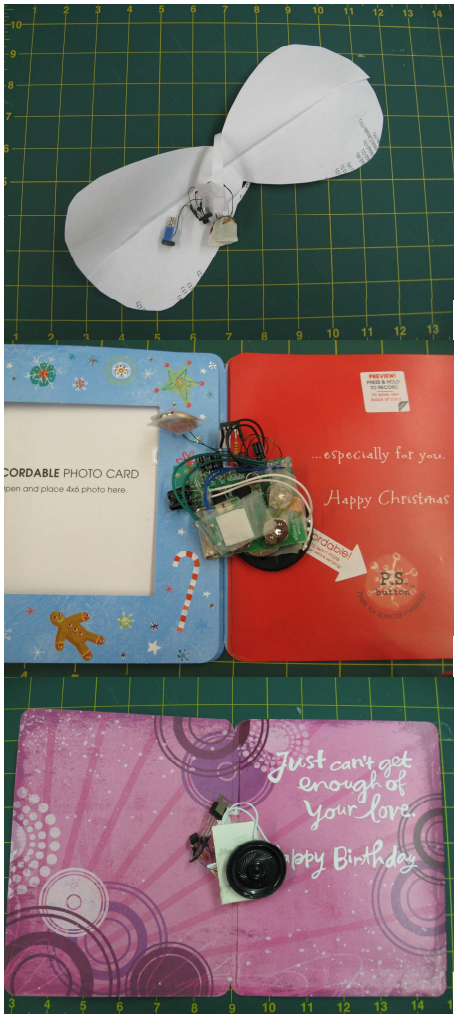

Figure 1. Top to Bottom: Prototypes of the Floating Throwie, the Ventriloquist Throwie and the Motown Throwie.

Telling Stories about Community: The Time-Lapse Keychain Camera

While "Throwies" explore public computing from an individual perspective, there is also a role for non-profits and other citizen-led organizations to create and explore technology collectively. To that end, we explored how individuals in communities can observe and share records of activity in public spaces. Specifically, we found inspiration in William Whyte's book "The Social Life of Small Urban Spaces." Whyte uses time-lapse photography to capture people's movements in New York's public plazas - and uses that footage to discover and tell stories about how the built environment and architecture of a place will influence how people use and experience it. Time-lapse photography (which was relatively new and expensive at the time of publication) allowed days of footage from dozens of locations to be collected, allowing the author to compare and contrast public spaces across the city. [7]

Since the 1970s, film cameras have been mostly replaced by digital photography - and the resulting rise of closed circuit security, commonly used for surveillance, hints at applications beyond surveillance for recording of public spaces by the public. We hope to use digital recording to let individuals reexamine and tell new stories about our communities. Specifically, by creating an open-hardware solution to public time-lapse photo creation, the process of telling stories via time-lapse can be democratized, and local citizens and non-profits will be enabled to find and tell new stories about public spaces.

To this end, we started by modifying the electronics of an off-the-shelf keychain camera. We chose the Digital

Concepts camera distributed by Sakar Inc. for our work due to its low cost ($10 each), size (1" by 2" in area) and ubiquity in US chain drug and convenience stores. The camera's physical buttons were wired up to a microcontroller such that the camera could be operated under software control. In this way, we allow the camera to take a picture from the same position at regular intervals, creating a time-lapse film.

Our initial experiments have yielded photographs of reasonably high quality. In photographs taken by our camera of a bus stop at a distance of fifty feet, individuals cannot be identified personally, but the number of people present can be reliably counted by hand (and, we suspect, by image recognition technique). Encouraged by these results, we have begun work with the Remaking Cities Institute at Carnegie Mellon University (CMU) to explore how low-cost cameras can be placed via magnets onto public transportation vehicles to capture photos from the vehicle in motion. This would allow us to observe pedestrian traffic both at the bus stops and on the adjacent sidewalks in a uniquely visual way.

We are also exploring how do-it-yourself robotics might be combined with this technique to allow robots to find and tell stories via time-lapse in public spaces. We are equipping the Living Environments Lab's existing "Wallbot" project, a robot with magnetic wheels which can travel on public walls and ceilings [4], with our camera in order to capture time-lapse footage of a public space from a unique angle. We eventually hope to experiment with autonomous photography behavior in public robotics, allowing robots to act as a co-creator of stories with everyday citizens by letting users choose when and from what angles time-lapse footage is taken. In this way, we hope to encourage citizens to engage in basic programming of technology that can be left in public spaces to observe and act on their behalf.

Figure 2: Top: A keychain camera is hacked via a microcontroller and outfitted with magnets for placement on a traffic pole near a bus stop. Bottom: Examples of time-lapse photographs retrieved from the keychain camera. Current camera resolution is 300 by 200 pixels from a $10 camera.

Conclusion

By committing to open and accessible techniques and technology, publishing our intermediate results in open forums like Instructables, and working closely with Pittsburgh's local community resources, we are creating devices that motivated individuals can use to bring urban computing into their communities today. Our near-future vision of urban computing that is both personal, deployed by individual citizens in communities for an individual's own reasons, and public, operating primarily in public spaces and designed to benefit others who use those spaces. While government will play an important role in mediating our discussions around technology and establishing community standards, citizen-led efforts in public computing will ultimately drive how computing will improve the places we all share.

Acknowledgements

We thank the Carnegie Mellon University (CMU) School of Architecture for their support through the Remaking Cities Institute and the CMU Human Computer Interaction Institute (HCII) for their support through the Living Environments Lab.

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