

Data HarVest: Physical and Digital Data Collection for Citizen Science

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Abstract

“Field Computing”, is an ongoing interdisciplinary research project to design and build wearable devices for use in citizen science applications. The works from this project is derived from the fields of wearable electronics, citizen science and environmental biomonitoring through a critical design perspective. *Data Har-Vest*, one of the works in this series, is a wearable tool that collects physical artifacts and contextual data about fungi for scientific surveys. An early prototype for this tool is discussed along with design considerations.

Keywords

Wearable Electronics, Citizen Science, Critical Design, Environmental Biomonitoring, Outdoor, Human-Computer Interaction, Textiles

Introduction

This research focuses on an interdisciplinary investigation across the fields of wearable electronics, citizen science and environmental biomonitoring. By utilizing a critical design approach, the tools and technology that come out of this project will provoke dialogue surrounding how we currently engage with the environment and what potentials interactions we could have, especially as non-scientists working in data collection for citizen science. This idea of citizen science is especially provoking in the context of critical design because it allows us to speculate how non-scientists and “non-experts” can contribute to scientific study (Kuznetsov, 2013).

In utilizing wearable electronics, this work builds upon previous research in how computing technology can be embedded into fabrics and garments by utilizing traditional textile techniques (Hartman, 2016; Kobakant, 2009; Orth, 2007). Technologies and designs that have been previously developed for environmental biomonitoring and citizen science work are also incorporated into these projects (Kuznetsov, 2010; Paxton, 2009; Pierce, 2012; Tse, 2016).

One of these projects, *Data HarVest*, a wearable device

designed for data collection for mushroom specimen, will be detailed in this poster. This work researches and creates digital interactions and technologies that can be used to explore, facilitate and intervene in relationships between human users, non-human users (which include plants, animals and other organisms) and their environments.

With “Field Computing”, a critical design practice is leveraged to build wearable devices that draw attention outside of the user’s body and actions to connect them to how they interact with the environment around them. As environmental concerns are growing every day, these devices can play a critical role in sensing the changes around us to solve these problems.

Data HarVest

The current project in development for “Field Computing” is *Data HarVest*, a wearable device that can be used to collect physical artifacts and digital data from the environment. Specifically in this iteration, this device is focused on collecting information regarding fungi samples during a foray (See Figure 1). A foray is an informal scientific survey which can be conducted by amateurs or scientists in which a species, in this case mushrooms, are collected and catalogued (Lincoff, 1981).

Mushrooms, the fruiting bodies of fungi, are the targeted specimen for this iteration of this device due to their sensitivities to the environment. Depending on varying temperature and moisture conditions, mycelium, the vegetative part of a fungus that resides underground will grow and develop to produce the spore-releasing mushrooms above ground (Lincoff, 1981). Mycelia also absorb nutrients through their environments, in such that they can be used as a marker to track and reflect upon the overall health of the local climate (Money, 2011).

Figure 1. Fungi samples collected from a mushroom foray with the



Western Pennsylvania Mushroom Club

Through measuring and recording the conditions that various mushrooms are found in during a particular foray, the information can be used to help understand not just the various conditions for particular fungal growth, but also how an environment may change over time. Although this project is currently focused on mycology, there is potential for this device to be used in various other fields of research for data collection.

Using design research methods, conversations and interviews with members of the Western Pennsylvania Mushroom Club, were conducted to gain insights to the necessary design and technology functions this device would require. Since the device is designed to support the foray through a wearable intervention modeled after vests used in fly-fishing, a garment that can hold multiple tools and gears for this sport. *Data HarVest* is a wearable device that needs to be able to store specimen, along with hardware components for data collection and function outdoor environments, design references from fly-fishing vests serve as a useful and informative guideline (See Figure 2).



Figure 2. Sample of fly fishing vests used in consideration for design of *Data HarVest*. From top-left clockwise: Char Bloom Vest, Allen Gallatin Ultra Light Fishing vest, Filson Fly Fishing Guide Vest, Filson Foul Weather Fly Fishing Vest



Figure 3. Soil sensor glove prototype that is used to detect moisture levels of the ground

In addition to helping citizen scientists collect specimens, *Data HarVest* supports logging of contextual information during the foray. Wearable sensor inputs includes GPS, temperature, soil moisture and voice recordings. Considerations are being made into the placements of these sensors on the user's body from a design and technical perspective (See Figure 3). By collecting a combination of physical artifacts and contextual digital data, this device allows its users to create a synoptic view of their environment.

Data HarVest will be refined and deployed within the context of local forays for mushroom exploration. The concept will be used to engender and study conversations with experts and non-experts on the role of wearability and technology in field work. Iterations will be made according to the usability and needs of these users out in the field. In addition, this device could potentially be used to collect, study and survey a large range of specimen in various contexts.

Conclusion

“Field Computing” is an ongoing series of interdisciplinary work that speculates upon the tools and devices necessary to compute and sense to aid citizen scientists in the wild. *Data HarVest* is one of the projects in the series based on this concept that explores the relationship between the body and the surroundings using wearable devices. Along with researching new methods of physical and wearable computing possibilities, future iterations and work will continue to take on a critical perspective of how technology and tools can be used in field research by citizen scientists to monitor the natural environment.

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Author Biography

Jen Liu is a researcher working at the intersections of technology, materiality and culture. She holds a BFA from the Maryland Institute College of Art in Baltimore, Maryland and is currently pursuing a graduate degree in Tangible Interaction Design.