Investigating Opaque Infrastructures: The Desktop Odometer

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Abstract

This demo presents the Desktop Odometer, a device that shows users the distance they travel when browsing the web, by tracking the total miles between their current location and the server from where they are requesting information. Upon connecting the Desktop Odometer to their computer via a web browser extension, users are able to see how far information travels while surfing the web in real-time. This new ability to 'see' how far information has to physically travel gives users an opportunity to grapple with and reflect on the physicality of the Internet's infrastructure, which otherwise may remain opaque.

Author Keywords

Infrastructure; Internet; discursive design; web surfing; opaque; odometer.

CSS Concepts

• Human-centered computing~Interaction design~Interaction design theory, concepts and paradigms

Introduction

The Internet allows vast sums of information stored throughout the world to be retrieved almost instantaneously. The incredible speed and efficiency at which the Internet operates obfuscates its own

To make the Desktop Odometer

Materials:
Raspberry Pi Zero W
SD Card (OS pre-installed)
Jumper Wires
LED Holder
Red, Blue, Green LEDs
Reset Button
LCD Display Module
Bread Board (Optional)
Cardboard (E-Flute)

Tools:
Soldering Iron
Laser cutter or X-ACTO Knife
Hot Glue

Software:
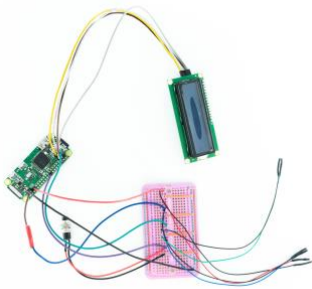Browser Extension Files

Fig. 2 Desktop Odometer Components

mechanics. In this project, our goal was to create an artifact that would let people see part of those mechanics in real-time. The Desktop Odometer allows users to observe certain aspects of the Internet's elaborate and largely invisible infrastructure in relation to how they use it. Recognizing the vast distances information travels while one navigates the web brings this facet of the Internet into the foreground of a user's experience.

The Desktop Odometer serves as a discursive artifact encouraging reflection. Discursive design, similarly to speculative design or critical design (e.g. [2, 5]), refers to the production of artifacts whose foremost objective is discussion and reflection [8]. By offering an experiential approach [1,3] to encountering the Internet's vast and complex infrastructure, the Desktop Odometer increases engagement between citizens and the information infrastructures upon which they rely.

The typical narratives surrounding Internet infrastructure reinforce a collective imagination that views these systems as frictionless, equally distributed, immaterial, wireless, and non-local [7]. Contrary to this popular depiction, Internet infrastructure is heavily wired, mostly centralized, and predominantly owned and operated by private corporations. The Internet's vast infrastructure is distributed (unevenly) all throughout the world and is made up of many different physical components, such as cell towers, satellites, antenna, optical fiber networks, and data centers. This extensive infrastructure allows for information to be stored and retrieved despite the immense physical distances between these processes [4, 6].

Fig 1. The Desktop Odometer

The Desktop Odometer

The information we access on the Internet appears immediately but usually lives far away. A search for holiday decorations might take you from a server in Montana to Delhi to Quebec. The Desktop Odometer tracks and displays the distance someone 'travels' on the Internet on a small 24 x 2 character LCD Display. The Desktop Odometer's outer shell is cardboard. The three device's LEDs indicate its status. The green LED indicates whether the device is turned on or off. The red LED means that the device is searching for but not yet connected to Wifi. When the device connects to Wifi, the Blue LED turns on, and the red LED turns off. The user connects the Desktop Odometer to the Internet via a web browser extension, which is free to download at the web address jerviny.com/extension. The Desktop Odometer's functionality is simple; users can watch as miles accumulate while surfing the web and can choose to reset the Odometer back to zero miles by pressing the black button on top of the device.

Quickstart guide & FAQ

We made a Quick-start guide and FAQ card to inform users about how the Desktop Odometer works as well as its ideological underpinnings. The Quickstart guide walks the user through the setup process (for instance, how to download the Chrome extension and how to connect to the Desktop Odometer). It usually takes around 15 minutes to complete. The FAQ was developed to serve two purposes: to explain that the Desktop Odometer is a product as well as a tool for research, and to explain to the users how We plan to use customer reviews within my research.
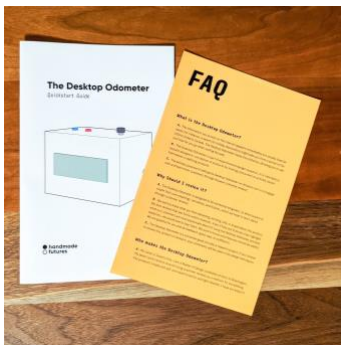

Fig. 3 Quick Start guide

Making the Desktop Odometer

The Desktop Odometer was made in five phases: Early Conceptual Work, Low-Fi Prototyping, Coding, High-Fi Prototyping, and Batch Production. Prior to building the functional Desktop Odometer, we used various approaches and methodologies to generate conversation and reflection surrounding opaque infrastructures. These explorations were valuable ways to speculate about the vast distances that information travels via the Internet, but without truly engaging with the device, the depth of speculation proved limited. While this early work provided an understanding of existing perceptions of information infrastructure, it seemed that if users could live with and use the device, they would be able to engage in more thoughtful discourse. Hence, we decided to produce the Desktop Odometer at a level of fidelity and robustness that would let people use it in their own spaces (at home, or at work, for example).

The making process began with Lo-Fi prototyping; this included selecting, assembling, and testing hardware. As design researchers with limited technical skills, we worked with a professional coder to create a downloadable web browser extension that tracks the distance between the user and the servers they ping while surfing the web. The browser extension identifies a website's IP address, then finds an area code associated with the IP address. Knowing both the area code of the user and server, the program calculates the distance between the two. The web browser then sends this information to the Desktop Odometer.

Once the hardware prototyping was completed, and the Desktop Odometer extension and operating system were working consistently, we made a higher fidelity

Desktop Odometer in which the components were soldered together. After completing and testing this first soldered prototype, we began to plan for batch production. This process involved breaking the production down into individual stages: sourcing materials from Alibaba, Amazon, and Microcenter; copying the Desktop Odometer operating system to the SD cards (which took 4 hours per card!); placing SD cards into the Raspberry Pi's; and soldering wires and components (LCD 24x2 character displays, three LEDs and one button, and the Raspberry Pi). We used E-Flute cardboard to construct The Desktop Odometers housing. To assemble each device, we first put the LCD 24x2 character screen in place within the laser cut cardboard housing, using hot glue to hold it. The Raspberry Pi's were then placed the box, followed by the circuit board and the LEDs. We then put the reset button in place using a hex bolt to secure it. Once all the components were put into position, the cardboard enclosures were sealed. We built a total of 48 Desktop Odometers.

Using the Desktop Odometer & Future Work

Ultimately, making the operational Desktop Odometer allowed us to use the artifact as a tool for inquiry. Given that the device is functional and user-friendly, we were able to list it as a product for sale on the Amazon marketplace. By selling the Desktop Odometer on Amazon, we were then able to elicit user-generated content in the form of customer reviews. Our FAQ and the product listing page on Amazon informed customers that this product was a research project, and that their reviews would be used in a research context. While future work will include a qualitative analysis of the customer reviews to describe more precisely the types of discussions generated, the questions surfaced, the

Customer Review

By: Taylor

Date: 01.30.19

Rating: 3 out of 5 stars

Title: I went 43.68 million miles in a day

Review: It was a productive day of grading my student assignments online, and researching a new artwork I want to make, which racked up the miles. I'm merely sitting, or standing at my desk, yet my actions are reaching great distances. Action at a distance; I feel so powerful. My desktop odometer made me feel quite accomplished at first, until I recalled the recent article in the New Republic, "Can the Internet Survive Climate Change?" In it, I learned that the internet "is the largest coal-fired machine on the entire planet, accounting for 10 percent of global electricity demand."

assumptions made, and the blind spots left untouched, below we share preliminary findings.

When compared to the vast majority of connected objects, the Desktop Odometer is unique in that it is not created with the intent of enhancing efficiency or accessibility, nor can it be used for automation. However, it has been effective at doing what is supposed to do: generating discussion about the inner workings of the Internet which have taken place in a public and online. In fact, various customers who have purchased the device have left reviews. In what follows, we briefly elaborate on some of the themes which have emerged through our preliminary thematic analysis of customer reviews.

By showing the miles traveled when using the web the Desktop Odometer shows actual distances. In her review (see sidebar to the left) Taylor wrote: "*I'm merely sitting, or standing at my desk, yet my actions are reaching great distances. Action at a distance; I feel so powerful*." The transmission of information over immense distances becomes a gateway to grappling with the physicality of the web. As seen by Taylor's review, once a consumer starts to grapple with the hidden infrastructure behind their computer screen, other realizations may follow. Engaging with the Desktop Odometer led some users to consider the Internet's effect on climate change relative to their own practices. For instance one customer responded by writing, "*you still are burning fossil fuels etc. because all that internet cloud stuff is actually happening here on earth in city sized servers all over the planet that are using tons of energy (fossil fuels etc.) and helping with global warming and destroying the*

environment..."(Customer Connie). For Connie, the Desktop Odometer created experiential connection between a simple web query and the energy required in supporting and maintaining the web. In conclusion, similar to current users of the Desktop Odometer, we hope to present the Device to the DIS community so that they can also experientially engage with facets of the Internet's Infrastructure.

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