
WiredRadio: A Study of Living with Radio Awareness

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DIS'18 Companion, June 9–13, 2018, , Hong Kong
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ACM ISBN 978-1-4503-5631-2/18/06.
<https://doi.org/10.1145/3197391.3205423>

Abstract

This paper reports on early field explorations with WiredRadio. WiredRadio is a device that intercepts 2.4GHz radio activity and based on the received data signal strength activates a motor with a string attached to it. Similar to the classical 'dangling sting' installation by Jeremijenko, the more wireless network traffic there is, the more will the string move. The paper discuss insights derived from a field deployment where WiredRadio was installed in a family house for three weeks. The insights deals with the family's perception and understanding of WiredRadio, their relationship with WiredRadio as an artifact and ambient display and how WiredRadio influence their understanding of wireless data traffic and what it may represent.

Author Keywords

WiredRadio; Notifications; Ambient display; Radio; 2.4GHz; WiFi; Experiences; Experimental Engineering.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction

Across the entire world Radio waves of different wavelengths are omnipresent. In our homes, workplaces and urban public spaces WiFi and Bluetooth

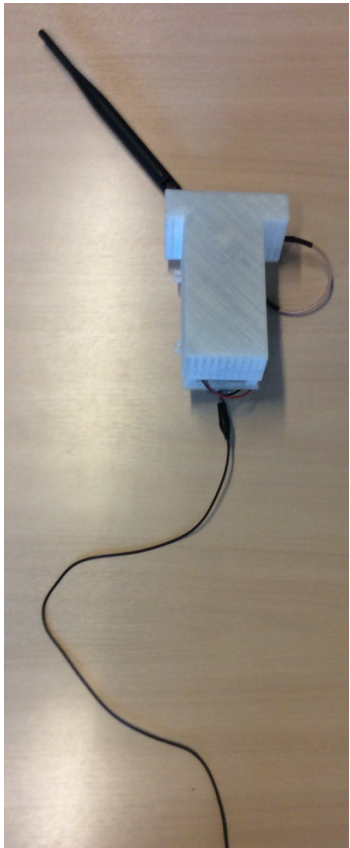


Figure 1. WiredRadio with a black string connected to it. At the end of the string a small weight can be attached to smoothen its movement as the motor turns.

often surround us. Even if we personally do not use a smart phone or actively browse the web, WiFi and other radio signals pervade our everyday spaces. These signals remain undetected by us without technology. Radio is in many ways a hidden infrastructure, and likewise is data transmitted over radio hidden to us. In a way, one can say that radio and radio traffic only 'materializes' through active use.

WiredRadio is a hardware device with a motor and a string connected to it (see Figure 1). It takes direct inspiration from Natalie Jeremijenko's classic "Dangling String" installation [8] where a string, connected to a motor, moves as data packages pass through an Ethernet cable. WiredRadio is similar, but its string moves based on 2.4GHz signals (like WiFi and Bluetooth data). It does not connect to a specific hotspot, but rather listens for any 2.4 GHz signal. WiredRadio is wireless in that it can be powered from a battery and reacts (i.e. swirl the string connected to it) based on intercepted radio signals' strength. The more and the stronger the signals, the more the motor and the string will rotate or move.

WiredRadio allows people to perceive, and change their relationship to radio signals and what they may represent. Something that may go beyond the content of the actual message being transmitted. WiredRadio has been deployed and explored as an ambient display in two smaller studies. In each of the two studies, WiredRadio was installed in a family home for a few days (study 1) and for three weeks (study 2). This paper reports on findings from the second study.

What will now follow is a brief Related Work section followed by a more technical description of WiredRadio.

Afterwards, the study and some of its results will be presented. The paper concludes with a brief discussion.

Related Work

As previously mentioned, an obvious source of inspiration is Jeremijenko's classic "Dangling String" installation [8]. On an overall functional level, WiredRadio is identical but utilizes radio rather than wired data traffic for its activation. Being wireless, WiredRadio can be placed anywhere and will react to the radio environment at that particular place and time and is hence not bound to a particular network outlet.

WiredRadio is also inspired by works that in different ways make perceivable what normally is hidden to our senses. WiredRadio is tightly linked with the concept of Hertzian Space, being a tool to explore the interface between radio waves and human experiences [3]. Another related project is FeltRadio [4]. FeltRadio also intercepts radio signals but uses on-body notifications to create a more private experience of, for example, WiFi traffic. Similarly, the Detectors project [5] creates an audioscape of radio signals and sources present in a space. The project 'Immaterials: light painting WiFi' from the Norwegian School of Architecture [1], renders WiFi signal strength visible through a long rod with LEDs on it. The stronger the connection is with a WiFi station, the more LEDs on the rod are turned on. WiredRadio is similar to FeltRadio as it detects similar signals, but where FeltRadio gives a more private on-body experience of WiFi and radio traffic, WiredRadio is more of an ambient display visible (and somehow audible due to motor noise) by anyone in the same space. Compared with the Immaterials light rod, WiredRadio is realtime and works on the data being transmitted rather than the signal strength of a

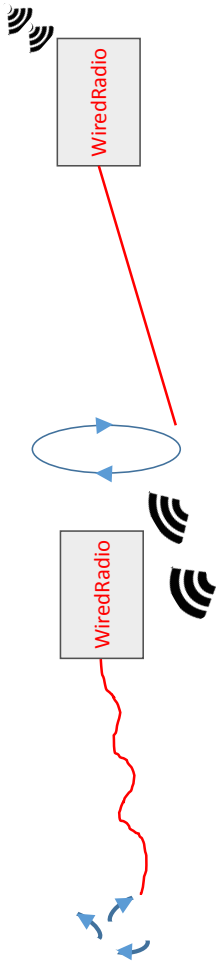


Figure 2: WiredRadio example behavior. Soft circular movement or more aggressive bursts.

particular base-station of network. As an ambient display, WiredRadio draws on numerous works including the classic AmbientRoom and Ambient Fixtures [2, 9]. The Ambient fixture Pinwheels have among other things been used to render wireless traffic perceivable to humans [2]. WiredRadio can be perceived as Experimental Engineering [7] as it is a combination of technologies that allow for new understandings of people, technology, and their interactions. It is through its aesthetical interaction [6] qualities that it become unique and a probe for understanding humans, technology and their interactions in a reflective manner.

WiredRadio

WiredRadio is, as described above, a device that take WiFi, Bluetooth and other 2.4GHz radio signals and based on their signal strength activates a motor. To the motor, a short piece of string (about one meter) is attached and this string will 'dance' each time the motor is activated. A threshold is set to activate the motor only if a signal is above a specific strength. The system is constructed out of three main parts: A) a radio frontend and antenna. A specific band-pass filter together with a wideband radio receiver (model AD8313) selects the right frequencies and converts the intercepted signals into voltage (i.e. an intercepted signal strength to voltage conversion). The stronger the signal (in the 2.4GHz band) the stronger the voltage. B) The created analogue signal is amplified and tested against a set threshold. If the voltage (i.e. signal strength) is above the threshold value (set via a potentiometer) the signal is forwarded to C) a small motor with a string attached. The output behavior (i.e. the string) can be for example continues, smooth and slow or more aggressive and come in bursts (See

Figure 2). If the intercepted signal is steady (like from streaming) and not that strong the string will rotate in a constant, slow, rotational movement but if WiredRadio picks up strong bursts of data the motor will make the string twitch in short, rapid movements.

Early study insights

WiredRadio was deployed for three weeks in a three-person family's kitchen (See Figure 3). The family is composed of a mother and her two teenage daughters. At the start of the study, the family members were introduced to WiredRadio and instructed to compile a study-diary as part of the study. In the diary the family-members were asked to reflect on and share their thoughts and experiences of WiredRadio. After the three-week study period a semi-structured interview was also conducted with the family members.

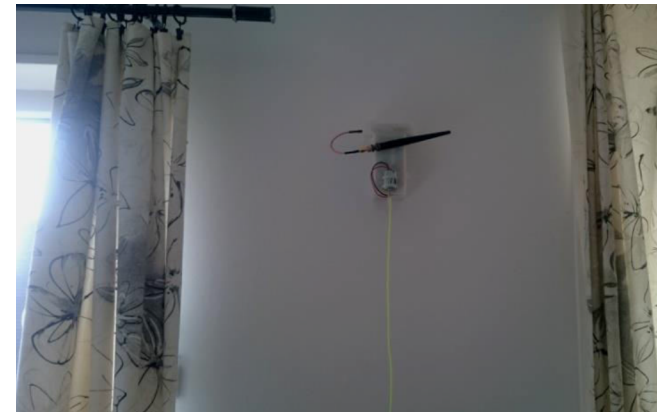


Figure 3: WiredRadio on the test-family's kitchen wall.

The study show that initially the family members were very aware of WiredRadio and its presence in the home. They reported for example in the diaries that it

made much noise (the motor and wire as it rotates) and they even find WiredRadio disturbing to the degree that they sometimes turn it off. As the study progressed, they accept WiredRadio more and more into their lives and WiredRadio moves from being a foreground to background artefact. About halfway into the study, the family name the device 'Egon'. At this point the family members report that they also sometimes say 'hi' to 'Egon' as they get home. One of the family members states in the post-study interview, when asked if WiredRadio has a sort of personality, that *"it has been a part of the family... and an active part one may say [laughter]"*. The family members did not really engage in any deeper reflections, for example in the diaries, about WiredRadio. Such reflections only came forth to some degree when directly asked during the final interview. They did however report on a new level of awareness that came from living with WiredRadio linked to the family members and their activities in the home. During the study the participants reported that they had for example learned to interpret the movements of 'Egon' (see Figure 2) to distinguish between the net-activity following streaming and 'general browsing'. Another example is how the mother became aware, through WiredRadio, when the daughters wake up in the morning as exemplified in the following interview extract.

Daughter: You [to the mother] told us that you can see when we wake up. You can see when it [WiredRadio] start to show that we use our mobile phones.

Mother: Yes Yes. It [WiredRadio] is completely still in the morning, but as soon as the girls wake up, and I am sitting here with my cup [of coffee in the kitchen], and they wake up at 06:30... tjov tjov tjov [imitating

the sound of WiredRadio]. So can I see that they are awake. Yes.

The family members did see WiredRadio as something that indicated their own WiFi usage, and not that of their neighbours. It is however very possible that some 'movement' in WiredRadio came from neighbours net activity rather than their own. The last 3-4 days of the study WiredRadio stopped working. The family members cannot state exactly when it happened but mentions that it became 'lonely' without its activity.

Discussion

This paper introduced WiredRadio and reported on an early field deployment and exploration of it. During the test, a family of three lived with WiredRadio for three weeks and reported on their own thoughts and experiences that emerged from the WiredRadio field test. During the test, WiredRadio went from being a foreground, novel, artifact to melt into the background and the everyday life of the family. The reported on study is part of a larger work on hidden information sources in everyday life and what may happen if we in different ways become aware of, make sense and use data that is omnipresent in our ambient that we today are not aware of, or cannot utilize, as our human senses cannot sense them. While WiredRadio did not lead to any deeper reflections among the family-members on WiFi, net-usage etc it gave them new insights into their own everyday routines and activities.

Acknowledgements

I like to thank the students Steffen Hviid Trier and Morten Mansdal Larsen for their valuable work with the study. I also like to thank all study participants.

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