
Do You Want to Talk to Your Router? Probably Not!

Sajad Shirali-Shahreza,
Gerald Penn, Yashar Ganjali,
Ravin Balakrishnan
University of Toronto
Toronto, Ontario, Canada
{shirali, gpenn, yganjali, ravin}
@cs.toronto.edu

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Introduction

There are visible signs that home users face various problems with their home network: 25% of purchased wireless access points were returned in 2010, not because the equipment was faulty, but because users could not install them correctly [7]. A significant number of wireless home networks are unsecured [9] or perform suboptimally because a crowded channel has been selected (26% of households [6]). Furthermore, there are important desirable functionalities such as access control and security that are hard, if not impossible, for users to achieve by themselves [8].

A home network is an interactive system inside the home: it has information that should be transferred to the user (e.g., when an unknown device tries to connect to the network) and requires user commands for some operations (e.g., allowing or banning that device). So an important question is how it should interact with the user. While some previous work has proposed different new user interfaces to solve the home-network usability problem, none of them investigates what the best interaction modality between a home network and its users is.

A good way to find out which modality users prefer for interacting with their home network is to directly ask them. This could be done either through interviews or

surveys. Interviews are absolutely essential for probing the questions in detail with a smaller group of participants, whereas surveys are an efficient means of addressing simple questions to a large number of participants. This paper reports on the results of part of an online survey, in which users were asked to rank different input modalities together.

We collected users' opinions about best-practice interaction modalities through an online survey. The survey was designed to be relatively short, one that could be completed in less than 15 minutes. Participants who completed the survey could submit their email address to be entered in a draw for one \$100 and two \$50 cash prizes.

Participants were recruited through three different channels: paper flyers in a student family housing high-rise, a post on a popular Canadian online forum, and paper flyers in university labs. 123 users completed the survey.

For this ranking of input modalities, participants were asked to consider different use cases in which they may interact with their home network and the advantages and disadvantages of each input modality. They were given the role of wanting to buy a new wireless access point from among a selection of 8 different products, each providing one input modality. The users had to rank the products according to their first choice, second choice, and so on.

We selected the following 8 different input modalities that users could use to provide their commands to the home network: *Web Interface* (select one of the available options through a web interface), *Buttons on Device* (press one of a series of buttons on the device), *Touchscreen* (select one of the different options shown

on a touchscreen display, either on the device or mounted on a wall), *Speech* (say which option they want), *Email* (send an email containing the selected options to a predefined email address), *SMS* (send an SMS containing selected option), *Smartphone App* (select the option through an application program running on a smartphone), and *Computer App* (select the option through an application program running on a desktop or laptop computer).

Survey Results

The users were asked to rank 8 different input modalities from best to worst. The average overall rankings are shown in Figure 1. The Friedman test shows a statistically significant difference ($\chi^2(df=7, N=123)=118.2, p<0.00001$) among different modalities. Wilcoxon post-hoc tests with Bonferroni correction show that Speech is the worst method. After Speech, SMS is statistically significantly worse than the remaining modalities except Computer App. Among the remaining pairs, only Computer App is statistically significantly worse than Web Interface. So we can rank them approximately as: Speech < {SMS, Computer App} < {Buttons, Touchscreen, Web Interface, Email, Smartphone App}.

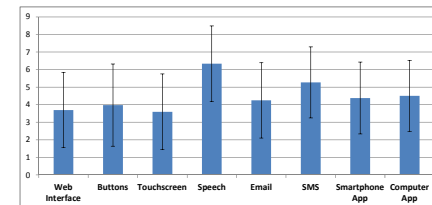


Figure 1. Average overall ranking of input modalities.

Discussion

If we only look at users' opinions, it clearly shows that not only they did not welcome the idea of talking with their routers, it seems that they hated it. Although it is an important fact that users do not like speech for home networks, this does not mean that a spoken interface is a bad idea for home networks. Possibly users wrongly disapprove of it and we need to make additional efforts to convince them to start using one. Speech has a number of advantages over other input modalities. These include:

Cost: speech only requires a microphone and software control to capture the audio, which is very inexpensive in comparison to, for example, the touchscreen option - the top choice by users, probably as a result of widely expanded touchscreen smartphone and tablet penetration in society, which is also common among designers [3, 10, 11]. Touchscreens cost at least around \$5. Simple (i.e., small vocabulary) speech recognition can be performed locally, without the need for network access or an outside server as SMS or Email do. This outside server requires ongoing maintenance and costs from the provider.

Access Information: While modalities like *Buttons*, *Touchscreen* and *Speech* could be used out of the box without any device-specific information, users need to know some kind of access information to use other options, e.g., the email address or SMS number that should be used to send commands, or the URL of the gateway for Web-Interface and Smartphone/Computer App. Not only does this make it difficult for non-expert users to perform [2], but even expert users may forget it if they have not used it for a long time.

Access Device: Users do not need any additional device to talk to their routers, while they need a smartphone or computer for most of the other options. Furthermore, in the case of using another device, e.g., a web-interface, there must already be a semi-operational network. This makes them far less useful for initial setup. It also makes troubleshooting more complicated because the access device itself could have contributed to the problem with the network [12]. Web interface is nevertheless the most common option among proposed home network solutions [4, 9, 14], probably because it is the easiest option to implement and *de facto* interface for commercial home gateways.

SMS, Email and Smartphone/Computer App, if they want to provide access from anywhere, also require an active Internet connection, further limiting their usage in troubleshooting.

Operating Range: While needing network connectivity limits the usefulness of methods that require an access device, it provides flexibility in using them. One could use those modalities from any place in which an access device could communicate with the gateway. However, other modalities have a limited operating range: *Buttons* or *Touchscreen* need physical access to the device (i.e. a few centimeters operational range) while *Speech* could be used from anywhere in the room, i.e., within a few meters operational range.

Although a limited operating range may cause problems because users must compromise among different criteria when they place devices [5, 8], they also provide physical security [1]. For example, only people present in a room can select options through Buttons, Touchscreen or Speech, so we may not need to ask for passwords for authentication [13].

Conclusion

In this paper, we tried to explore an important question about home networks that has been ignored in previous work: what the best modality is for interacting with a user of home network devices. Our survey results have one clear message: users do not want to talk with their routers.

Although speech has a number of considerable advantages over other options, as reviewed above, the negative mindset of users makes it difficult to incorporate spoken interfaces. We may need some kind of mechanism to encourage or force users to at least try it once. Otherwise, they may simply stick to other options that they prefer. A similar dilemma faces the command-and-control speech recognition feature that is present in many operating systems and word processing software; only a small percentage of people have tried it at least once, or are even aware of it.

The question that we should answer now is: why do they dislike speech as an input modality? A follow up survey or interview will be conducted to answer this question. For example, we may assess their previous experience with spoken interfaces, to test whether a negative previous experience is the main reason or not. Another way to answer this question is to design user studies that test speech versus another modality with respect to some task, and then use pre- and post-study questionnaires and post study interviews to see whether or not their opinion changes after one try.

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