
The Connected [Work]Life

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Abstract

As workstyles change to include more dynamic contexts and denser spaces, connected objects and spaces in the workplace can play a bigger role in helping people get their work done, while also helping them navigate the continually blending boundaries between work- and home lives. In this talk, we argue that the workplace is particularly well-suited for realizing the “connected life” by including both company-initiated sensing in the workplace and personal tracking devices introduced by individual workers. We describe some examples of ubiquitous sensing in the workplace, and future opportunities as well as open technical and ethical issues for designing for the connected [work]life.

Author Keywords

Connected Life, Internet of Things, Work, Workplace

Introduction

The growing influence of mobile computing and constant connectivity in people’s daily lives, has dramatically affected how work is done. Traditionally performed in an office building with its cast of regularly scheduled full-time workers, knowledge work is increasingly distributed [1], with workers continuously communicating with each other both synchronously and asynchronously. At the same time, workspaces are getting more concentrated and denser [2], enabling

more opportunities to sense and understand people's interactions with each other, the objects around them, and their environment. Knowing about that location and activities of co-workers, customers, products, and business partners can give an organization a competitive edge. However, these deployments are not without technical and ethical challenges.

Furthermore, as IT opens up to workers' use of personal devices in the workplace, a blurring between consumer and work-related opportunities continues. In addition to the consumer setting, the workplace can be a fruitful environment for developing and using new cloud-connected objects and spaces.

At FXPAL, we research opportunities for shaping the future of work using intelligent systems. In this talk, we discuss how the context of work can be a good setting to explore the use of increasingly connected spaces, objects, and people. Workplaces have the following traits:

1. Expedited adoption of technology is possible using top-down organizational structure combined with a well-defined user base. A "push" approach can lead to more complete adoption, in contrast to the "pull" approach common in the consumer-space which can be fragmented, lacking the critical mass to become mainstream.
2. Easy integration of sensing and instrumentation in the underlying infrastructure, tools, and ways of working. In fact, many devices are already cloud-connected. For example, printers send messages to IT admins when their toner is getting low.

3. Workers have to constantly negotiate the boundary between their work and non-work lives, often using the same digital artifacts to coordinate both.
4. Fundamentally, workers often need to be connected with each other to get their work done. Connected things and spaces are well suited for supporting a greater awareness of others' activities.

The "connected life" is not simply having people connected with their own data trails, but also connected with the people around them, an important value both in the work setting as well as in the consumer space.

Examples from the Connected Workplace

We will briefly discuss some examples to illustrate how incorporating sensing in spaces and devices in the workplace can facilitate better work practices, connectedness, and wellness among workers.

myUnity [3] is a system that provides awareness information such as availability, status, and preferred communication medium for workers. By integrating sensing from multiple modalities including the mobile phone, physical office rooms, office phone, and desktop computer to infer an accurate estimate of the presence and availability of co-workers. Critical to the adaption of myUnity was the design decision to allow different levels of information disclosure that correspond to different levels of commitments from the user.

An evaluation of myUnity showed that not only was capture from multiple modalities important, but giving users the ability to access availability information on multiple modalities (desktop, mobile, and face-to-face)

made the information useful regardless of the places, situations, and contexts of people's lives.

LoCo [4] is a localization framework that relies on combining WiFi, Bluetooth Low Energy beacons, and a simple app on a mobile device to infer the location of people and objects in indoor environments. The framework pre-dates localization systems like Apple's iBeacon. Using a boosted classifier, LoCo can achieve room-level accuracy near 98% indoors without requiring the individual to carry additional hardware beyond their mobile phone. Accurate indoor location information from LoCo can enable richer interactions with spaces and objects such as recognizing impromptu meetings, sending media to nearby printers or displays, and authenticated access to a space, tool, or resource based on presence of one or more users (using the LocAssure [5] infrastructure and protocols).

LoCo was deployed in a large financial corporation in Australia to measure patterns of space utilization. We will discuss a case study of the initiative by the corporate leadership to have the LoCo framework installed and deployed to make a more intelligent workspace. We will discuss some of the challenges, early successes, and lessons learned from this real-world deployment.

Quantification of personal behaviors in the workplace can also lead to worker wellness and productivity. For example, a study [6] about taking breaks during work showed that individuals were often surprised when reflecting on visualizations of their break patterns, leading many to want to change their break-taking practices so they would feel more refreshed and productive. Corporate wellness programs [7] already

are starting to invite workers to link and self-report wellness behaviors, further blurring the boundaries between personal and work lives.

Future Opportunities

Traditional applications of IoT in industry include monitoring equipment lifecycle, environmental health conditions, and quality control. In the talk, we will propose some new opportunities for more worker-centric applications of a more quantified, sensed workplace. For example, instrumented tools, objects, and spaces can help with sensing the contexts of work, which can enable more dynamic workflow and task management strategies. Smart objects, including workers' own personal devices for tracking activity, stress, routines, and goals, can be used to motivate behavior change such as workplace wellness, corporate citizenship, eco-behaviors, and continuing education. Instrumented spaces and objects can also enhance the experience and accessibility of mobile tele-present workers to help them navigate remote spaces and operate remote objects.

Open Issues for a Connected [Work]Life

Although the workplace can be a good setting to apply ubiquitous sensing—ambient, wearable, or otherwise—our experience has given us insight into a few important technical and ethical issues that need to be considered in future work.

On the technical side, large deployments of new infrastructure and the proliferation of connected things in the workplace will require substantial effort from IT support departments. IT departments will need ways to manage not only the traditional device suite of PCs, peripherals, phones, and tablets, but also smart

lightbulbs, desks, floor tiles, personal trackers, and other things previously unconnected to corporate IT.

On the ethical side, the use of additional sensing and tracking, even if done benevolently for wellness or sustainability purposes, can create a tension between the workers whose actions are tracked and the management who get to view and use the data. It is not always clear who will be the owner of the collected data and whether workers will have or want control over that data. One example is OccupEye [8], a commercial system for analyzing office space usage that received negative reactions from employees at the *The Guardian* newspaper who felt their attendance was being surreptitiously tracked by the company [9]. An open challenge is to find ways to design sociotechnical systems that can provide workers adequate anonymity (and benefits) but also provide the administration with sufficiently transparent data for gaining insights into the behaviors of interest.

Conclusion

The “Connected Life” is realized most strongly when people are connected to the devices, data, and people around them. The workplace, whether confined to a dedicated space, is mobile, or combination of the two, provides a good setting to experiment, deploy, and actually use systems that rely on pervasive and connected objects to connect people with other people through objects and their data.

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