QUICKIES: INTELLIGENT STICKY NOTES

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Abstract

In this paper, we present 'Quickies', an attempt to bring one of the most useful inventions of the 20th century into the digital age: the ubiquitous sticky notes. Sticky notes help us manage our to-do lists, tag our objects and documents and capture short reminders or information that we may need in the near future. 'Quickies' enrich the experience of using sticky notes by allowing them to be tracked and managed more effectively. Quickies are sticky notes that have intelligence and the ability to remind us about the task we ought to perform or to provide us at the right time with the information we captured in the past. The project explores how the use of Artificial Intelligence (AI), Natural Language Processing (NLP), RFID, and ink recognition technologies can make it possible to create intelligent sticky notes that can be searched, located, can send reminders and messages, and more broadly, can help us to seamlessly connect our physical and digital experiences.

1 Introduction

Since 3M's introduction of Post-it Notes in 1980 [1], sticky notes have become an integral part of our everyday life – accumulating and keeping track of all sorts of information. In an office, sticky notes are often seen on desks as meeting reminders, to-do lists and contact information; on whiteboards as brainstorming devices; and on paper documents as brief note to the recipient about the content or intended purpose. Sticky notes are also found at home mostly near telephones or on refrigerators as household reminders and messages. Sticky notes are usually seen in books as bookmarks. In addition, we also use sticky notes to tag our assets for personal or social usage. In short, sticky notes are everywhere. Unlike most of our modern digital information devices, sticky notes are portable, low cost and easy to use. As a prognostication to the web, sticky notes offered an easy way to link one piece of information to another in a precise contextual manner. As a forerunner to email, they made informal, asynchronous communication a major part of our modern daily life.

They are no short to modern computer-based task-lists, calendars or address books.

However, as written sticky notes accumulate, keeping track of our stickies and the information they contain gets unruly. Desks, whiteboards, refrigerators, telephones and textbooks are inundated with sticky notes. As a result, stickies become lost, hidden or forgotten about. Furthermore, sticky notes have physical limitations; a particular sticky note cannot be in an office and at home simultaneously. Being a passive piece of paper, sticky notes lack the capability of dispatching reminders about upcoming events or deadlines. After scribbling details of a forthcoming occasion on a sticky note, one can still overlook the appointment due to forgetfulness. Like most paper-based media, sticky notes fall short as a medium that can communicate to other, especially digital, information media we use.

'Quickies' is an attempt to link physical and digital informational media and combine the best of both worlds in one seamless experience. Quickies are regular paper sticky notes that have been augmented in a few ways. First, each sticky contains a unique RFID tag, so that stickies can be located in different parts of a home or office. Second, we use a small digitizer, so that while a note is being scribbled, a digital copy is created. Character and shape recognition is used to translate the note's content into machine readable data. Finally, special-purpose knowledge, NLP and commonsense based AI techniques are used to interpret what the content of the note means and what relevant actions should be taken.

2 Related Work

Several projects and products have tried to use the metaphor of sticky notes in the digital world. The Post-it Digital [8] is a computer software program that provides users digital Post-it Notes. Although Post-it Digital features searchability, the scope is limited to the boundaries of a computer, isolated from the portable and convenient physical experience that paper sticky notes provide. There are more than a dozen similar software applications available today, all trying to imitate the simplicity and ease of use of physical sticky notes in the digital realm. Stanford University's Post-that Notes project [9], attempts to facilitate both searchability and portability, by creating a mobile phone application which

captures regular post-it notes as pictures within the mobile phone platform. Inspired by the use of sticky notes on whiteboards and walls during the early stages of a project, the Designer's Outpost [4] of the University of California, Berkeley presents a tangible user interface that combines the affordances of paper and a large physical workspace. The Designer's Outpost contains an interactive whiteboard with augmented sticky notes that allow users to collaboratively author website architectures. Rasa [6] is a system designed to support situation assessments in military command posts, providing officers the capability of positioning written sticky notes on a paper map with digitizers that simultaneously update a digital database system. TeleNotes [11] was one of the first attempts to provide, in the computer, the lightweight and informal conversational interactions that sticky notes provide. Projects such as HayStack [2, 3] use sticky notes as a metaphor to provide annotation for the semantic web. Projects such as DigitalDesk [10] use augmented reality to provide an integrated experience of both paper and digital documents.

Designer's Outpost and Rasa are designed for the specific needs of web developers and military officers, respectively, and as such are not generic systems. Post-it Digital and Post-that Notes in contrast are limited to computers and mobile phones respectively. TeleNotes and HayStack use the wonderful metaphor of physical sticky notes in our information world. There remains a need to have an integrated system which combines the qualities and affordances of physical sticky notes – portability, adhesiveness, low-cost – with the positive attributes of digital notes – effective information management and organization, automatic reminders and compatibility with the rest of the digital world. Provided their usage can be made as intuitive and efficient as that of regular stickies, the merger between physical and digital stickies can definitely be an added convenience to our fast-paced environment.

3 Quickies

3.1 What are Quickies?

Quickies are sticky notes that offer portability, connectivity to the digital information world, smart information organization, ability to be findable (searchable as well as locatable) and ability to send reminders. The following paragraphs present some usage scenarios and examples that demonstrate how 'Quickies' benefits users.

▪ Imagine you scribbled a sticky note about an upcoming meeting with a colleague; you placed the note on your desktop. Unfortunately, you overlooked the note, completely forgetting about the meeting and went for lunch with a friend. Luckily, your intelligent sticky note added the meeting to your online calendar system and reminds you about the meeting via a friendly text message on your mobile phone 15 minutes before the meeting (see Figure 1.)
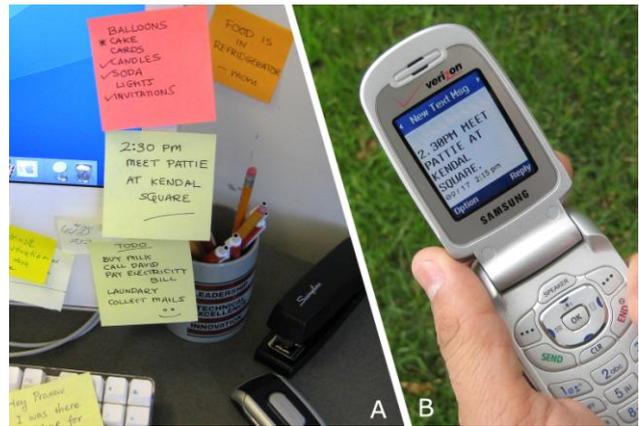
Figure 1. (A) Sticky notes at user's desk (B) Example of a reminder sent to a user's mobile phone.

▪ You write down a person's name and phone number on a sticky note while talking on the phone. That new contact is automatically entered in your computer address book.

▪ You create a grocery list or to-do list on a paper sticky note. This list is automatically synchronized with the task-lists in your mobile phone and computer. Now, your mobile phone has a list of the things you noted down to buy, which comes in handy when you are at the grocery store.

▪ Your mom prefers using paper rather than mobile phones and computers. She leaves a message for you on a sticky note when leaving for the market. The note recognizes that this is a message to you, looks up your mobile number in the contact-list and sends you her message as an SMS.

▪ You use a sticky note to bookmark a section about the 'Platypus Paradox' in Peter Morville's 'Ambient Findability' book. Several weeks later, a discussion about the 'Platypus Paradox' arises and you remember bookmarking Morville's explanation. You can now use Quickies' graphical interface to search for the keywords 'Platypus Paradox'. As the system is keeping track of all your notes in digital form, it shows all the relevant notes you have created in past. The system also helps you locate that note (and hence the book) in house.

We studied the usage of regular sticky notes by people and have identified some recurring cases of notes. Some of the most common cases we recognize are:

- ▪ To-do lists
- ▪ Reminders of a meeting or an appointment
- ▪ Contact information
- ▪ Messages/notes to another person
- ▪ Labels/tags on objects and documents

We have built a system to recognize these various types of notes and decided based on user interviews what the relevant actions are for the 'intelligent' quickies to take in those cases. For example, in the case of a to-do list, the right action is to merge it with the computer-based to-do
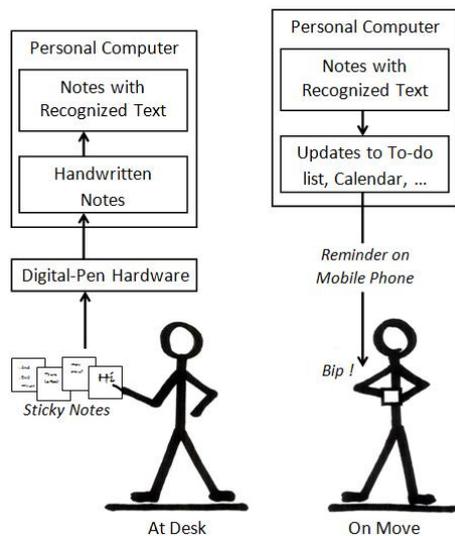
Figure 2. Overview of how Quickies work.

list; in the case of a note about an upcoming meeting, the right action is to add the appointment to the user's calendar and send a reminder 15 minutes beforehand; in case of a note to another person; the right action is to look up that person's name in the address book and send him/her an SMS or email message with the same contents. The software could easily allow the user to alter these default automated actions to their preferences. The subsequent sections describe how Quickies work and what makes these scenarios possible.

3.2 How do Quickies Work?

A high-level overview of how, in the first scenario, a reminder of a meeting appointment was sent to the user's mobile phone is shown in Figure 2. When at their desk, the user writes a meeting reminder on a physical sticky note, the information is simultaneously captured and stored as a digital note in the computer. A digital-pen hardware device enables this capturing. A computer program processes the digital note, recognizes and converts the hand-written text into digital text and applies some computational methods to understand the context and the content of the note. Since in the given scenario the note was about a meeting appointment, the computer program updates the user's calendar and also reminds him of the scheduled appointment at the appropriate time via a text-message on his mobile phone.

Figure 3 presents a more detailed explanation of how Quickies work. Physical sticky notes are captured and stored in the computer using commercially available digital-pen hardware, which captures the movement of the pen on the surface of a sticky note. The digital-pen hardware used in the prototype uses an ultra-sound wave sensing mechanism. Two stationary sensors receive ultra-sound waves that are emitted by a transmitter placed at the tip of the pen. The device measures the location of the pen tip on the paper using the calculation of receiving-time differences of the signals received by the two stationary receivers. A software program stores the handwritten notes as images/strokes and converts the
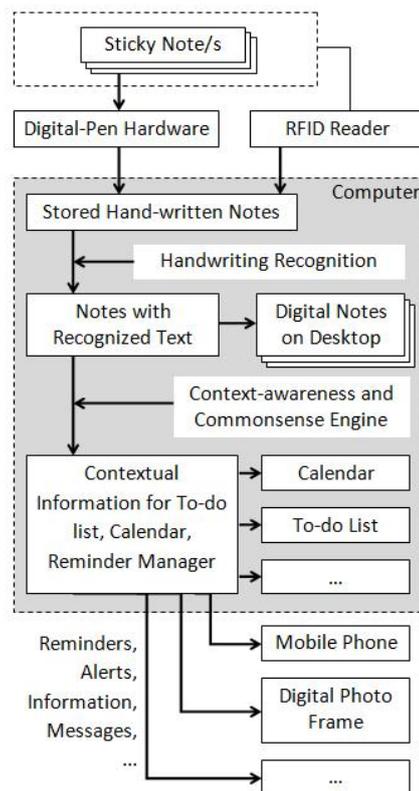
Figure 3. System design of 'Quickies'.

stored hand-written notes into computer-understandable text using handwriting recognition algorithms.

As shown in Figure 4, the computer program also provides a highly visual user interface to browse or search all of the user's notes based on keywords, time created and current locations. For example the user can ask "What are all the Quickies on my desk at work that contain the word 'Urgent'?" The recognized text is processed using a commonsense knowledge engine which is based on NLP and ConceptNet[5]. This process provides the note database with contextually rich information. Later, the computer program uses its understanding of the user's intentions, content and the context of the notes to provide the user with reminders, alerts, messages and just-in-time information.

One of the most interesting features Quickies provide is 'findability'. At the back of each of the Quickies is a unique RFID tag, which makes it possible to locate Quickies in the house or office. As shown in figure 5 'A' and 'B', the user uses a Quicky to tag the book given to her by a friend with that friend's first name. Some weeks

Figure 4. Graphical user interface of the 'Quickies'.
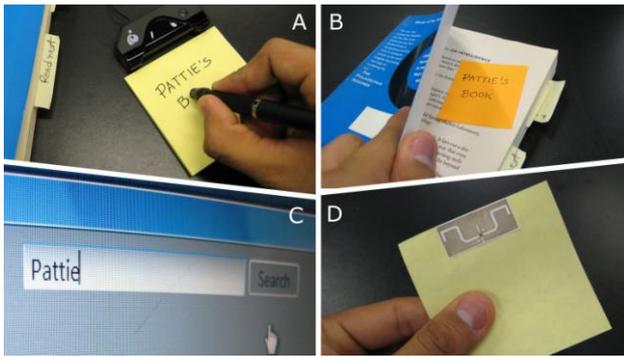
Figure 5. (A) User writes on a sticky note (B) User tags a book with the note (C) User searches notes related to the word 'Pattie' (D) A sticky note with the RFID tag on back.

later when the user wants to return the book to her friend, she uses the Quickies graphical user interface (Figure 5 'C') to search through all the notes she has created. By searching for her friend's name she sees all the notes that mention his friend's name. She can see the digital version of the note saying "PATTIE'S BOOK", which she used to tag the book. As shown in the Figure 5 'D', the note has an RFID tag on the back that gets picked up by one of the many RFID readers positioned in the house so that the book can be located. The computer program also provides other information such as when the user created the note, and all the different locations where that RFID tag (and so forth the book) has been detected in the past.

3.3 Implementation

We implemented a fully working prototype of 'Quickies' [7]. Hand-written note capturing is performed by the Pegasus PC NoteTaker. The software program is built on Microsoft.NET platform using C#, C++ and WPF. Handwriting recognition is achieved using Microsoft.Ink. ConceptNet [5], NLP, computational AI methods are used to build a commonsense knowledge engine that supports understanding of handwriting and context of the notes. UHF (902-928 MHz) RFID readers and EPC Gen 2 tags provide sticky notes unique IDs and link the IDs to content.

4 Conclusion and Future Work

The Quickies system bridges the gap between the physical and digital worlds, linking hand-written sticky-notes to mobile phones, digital calendars, task-lists, e-mail and messaging clients. By augmenting the familiar and ubiquitous physical sticky-note, the system leverages existing patterns of behaviour, merging paper-based sticky-note usage with a user's digital information world. A fully working prototype as described has been implemented. The next stage will involve user testing of this system. This will involve testing the system in two different scenarios: home and office/workspace. Two basic types of users, 1. Users who use physical as well as digital media for personal information management and 2. Users who only use physical media for personal information management, will use the 'Quickies' system

in replacement to their existing practice. Feedback from users will highlight problems with the design, and evaluate the effectiveness of the features described and help refine the design of 'Quickies'.

Acknowledgements

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